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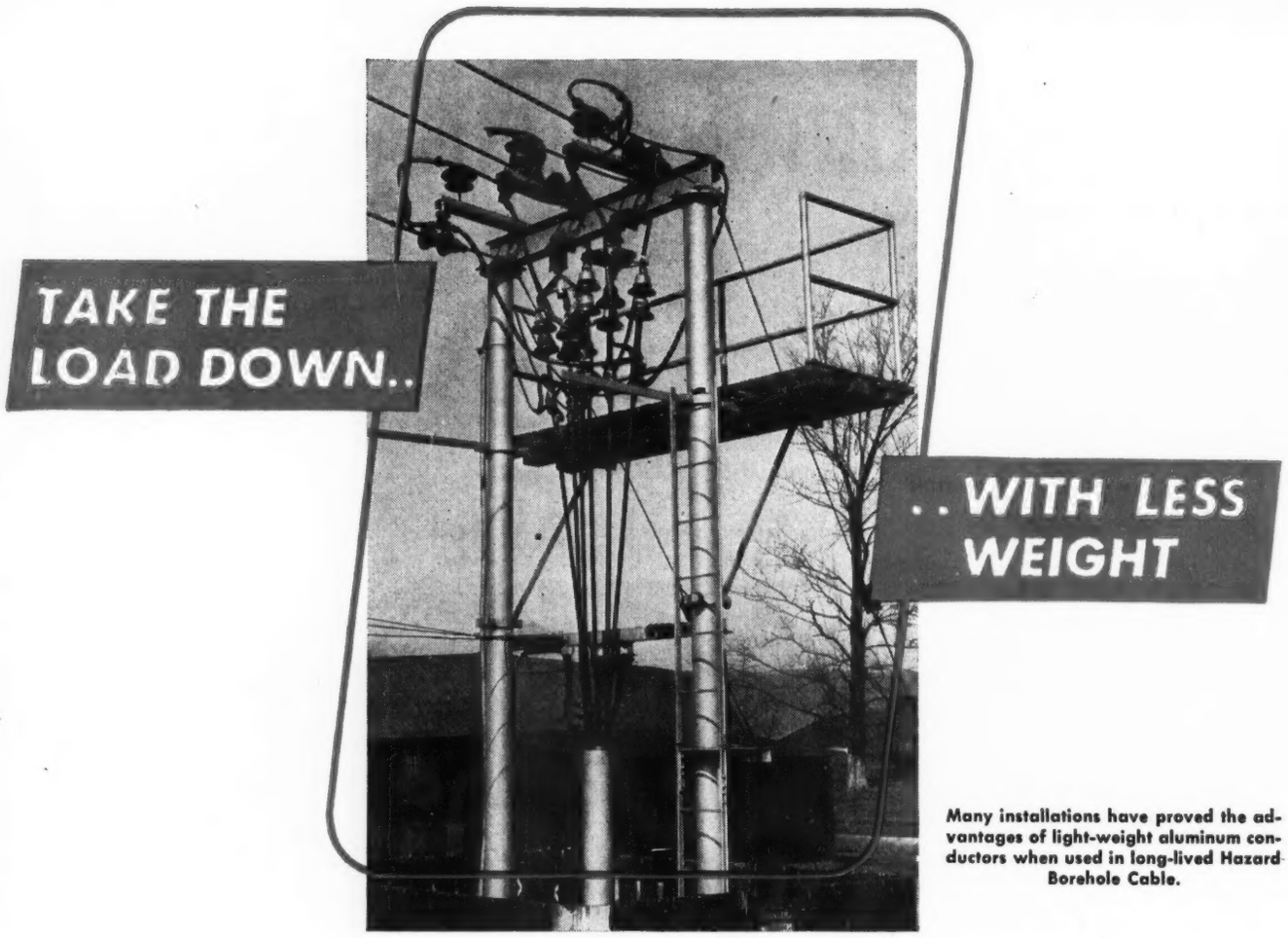

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ENGINEERING AND MINING JOURNAL

FEBRUARY, 1948

General Prospect Points to Good Mining Year

EVAN JUST, Editor

It would be particularly rash to indulge at this time in unqualified predictions over what will happen to the national economy in 1948. Nevertheless it is reasonably safe to say that the durable-goods industries will fare comparatively well and that capital-goods investments will stay at a high level. In other words, the mining industry will be among the most favored. However, unless the world economy greatly improves or the construction industry reorganizes itself for low-cost production, 1949 may be a different picture.

Why No Recession?

NOT SINCE 1929 has the economic future been more difficult to analyze. Also, with a great many others, having anticipated a year ago a recession that failed to materialize, we have learned to respect the complexity of our present economy, and to doubt anyone's ability to see more than a few months into the future at the present time.

Why did we expect a recession in 1947, and why didn't one occur? The premise was that the wage-price spiral was leaving too many customers behind and that, once the shortages generated by the war had been in large measure satisfied and surplus spending power dissipated, industry would need those customers. Was the premise wrong? We think not. Moreover, the substantial inflation that has occurred during 1947 has added greatly to the number of people who have to concentrate their expenditures more and more on subsistence items, and forego the luxuries to which they have been accustomed. Probably we are still headed for another 1921, but the war-generated shortages and accrued purchasing power are larger and take longer to dissipate. By the same token, it seems likely that the more exaggerated inflation subsequent to the Second World War will call for a more drastic corrective.

Deflation Probable

A year ago we believed that the amount of inflation then experienced would be permanent, except for a possible temporary dip, on the grounds that a substantial part of the war's cost would not be borne "straight up" but would be foisted on the creditor element by inflation. However, except to the extent that European aid expenditures may add to the debt load, we believe that inflation has now passed the permanent level and that its continued advance makes deflation more necessary and inevitable. Nevertheless, in regard to metal prices, we do not think those existing at the end of 1948 are very far above levels

which are likely to be permanent. In other words, six-cent lead and ten-cent copper are gone for good, except possibly during times of severe, temporary deflation. Not only are operating costs permanently on a higher level, but because of substantial depletion of deposits originally discovered decades ago and the decline in discoveries, the mining industry will have to weigh higher exploration costs into the prices of its products.

Supporting Factors

As always, some elements in the present outlook are new and different. Were it not for the European aid program, the paralysis of international trade engendered by hardship in Europe and the Orient would already be a drag on domestic business activity and mineral prices. However, the Marshall Plan will not only add to temporary inflation and the amount of debt which will land in the laps of creditors through permanent inflation; it will increase mineral consumption, intensify the depletion of domestic resources, and probably reduce the amount of scrap that would normally accrue in domestic markets eventually from domestic production. Thus, it and the stockpiling program add up as price-bolstering elements in the foreseeable future. Both of course may eventually be on the depressive side, in the one case if stockpiles are ever used to fill peacetime industrial needs, and in the other if plans ever materialize to obtain partial repayment for Marshall-Plan outlays in an artificially stimulated flow of mineral raw materials.

Capital Goods Strong

Of interest to mineral producers is a capital-goods investment survey made by the McGraw-Hill organization. This survey indicates that industry is planning on spending almost as much for capital goods in 1948 as was spent in 1947. If business conditions and the outlook remain good, 1948 may exceed 1947. The bulk of these investments will be made even if there is as much as a 20% slump in business activity. Thus, this important outlet for mineral products seems likely to hold up well during the coming year. However, there are signs that the capital-goods boom is weakening. Industry's expansion program was 62% completed at the end of 1947 and is expected to be 85% completed at the end of this year.

Because demands for most durable goods are still impressively in excess of supply, because capital-goods investments will continue large, and because construction is almost certain to keep going at a good level in 1948, we feel justified in the belief that the mining industry will be relatively favored during 1948, even if a general recession does occur.

Gold Depression Temporary

The likelihood that temporary inflation will continue for several months is, of course, bad news for gold producers. Permanent inflation is in the same category except for the probability that it will be reflected in a higher price for gold. Up to the present the full weight of the U. S. Treasury has been thrown against any movements toward acknowledging that most of the current inflation is permanent, even to the extent of intervening in Canada's plan to aid its gold producers. Nevertheless Italy's devaluation and France's notice of intention to do likewise indicate the strength of the tide which the Treasury is trying to stem. We hold to the belief that devaluation is inevitable and that the new international fiat currency—the International Fund—will prove to be no stronger than the paper on which it is pyramided. In other words we regard a higher gold price and continued need for gold in international finance as axiomatic. No large, powerful nation has ever withstood the temptation to incur government debt beyond the limits dictated by tolerable tax revenues. As a result, taxes become burdensome, and governments invariably try to maintain an appearance of stability by over-working the mechanisms of credit. After this process has been consummated, currency devaluation is not a positive act, but merely an acknowledgment of already existent bankruptcy. It is all too evident that in recent years most nations, our own included, have been less able to withstand temptation than those forbears whose financial derelictions throughout the centuries have resulted in higher and higher prices for equivalent units of human effort, a continued need for an unexploitable standard of value, and a higher and higher price for that standard.

Whither Subsidies?

The greatest controversy within the industry today is over the continuation of subsidies. Unquestionably this subject will be given new Congressional consideration and it seems likely that, despite the opposition of most of the big units in the industry, substitute legislation will be enacted for the Allen Bill which was vetoed last fall.

We suggest that both proponents and opponents would help themselves by an objective look at the problem. Most of the advocates want subsidies because their own operations would be helped. Their lack of objectivity was demonstrated by the failure to include a stockpiling

clause in the Allen Bill. Most of the opposition simply does not want to operate with bureaucrats pulling the wires.

Viewing the situation in broad perspective, the problem is one of national security. This calls for an industry in being and an appropriate balance between depletion and the establishment of new reserves by extension of mining operations. Virtually all informed analysts of this problem agree that it is worth some expenditure of public money, if necessary, to keep the mining industry on a good level as a bulwark of national security. This has been done in the past by the imposition of tariffs. The question the opponents of subsidies must answer to their own satisfaction is: "Can tariffs be expected to do the entire job in the future?"

We think not. In our opinion the era of high import duties is past in this country. This is not only because we must face up to the actuality of "one world" but because, on a national basis, support for tariff protection is dwindling and opposition is growing. The great pillar of political strength behind protectionism in the past, manufacturing industry, is now as much concerned with wider markets for expanded production, with adequately financed foreign customers, and with raw materials at advantageous prices, as it is with protection for its products. The effect of tariffs, even considering drawback privileges, is to raise prices, whereas subsidies tend to lower them. Also, organized consumer representation, a non-entity in the 'Twenties and previously, is a potent, new factor in political circles. Thus, in our opinion, the opponent of subsidies must reconcile himself to less overall protection for domestic mining than has been enjoyed in the past.

The proponent of subsidies has equally knotty questions to answer. If he considers the public interest—which is the only basis on which he can expect legislation to stay on the books—he must take care that stockpiling, conservation of derelict resources, and special encouragement to exploration are all covered. If he thinks of his industry's future, he must devise some plan that will avoid unnecessary bureaucratic control and will preserve enough competition to maintain the urge to be efficient. The answer to the latter might be to avoid a system that deals with operators on an individual basis and attempts to adjust subsidies to individual costs. We are convinced that equal treatment, or at least group treatment, has far less danger for the long pull than individual treatment, even though some companies may profit more than others thereby. Possibly a solution to the latter point, which must be weighed as having political as well as factual aspects, would be to require beneficiaries to expend profits in excess of nominal on exploration or research. The hope of benefit from exploration or research would provide an incentive to maintain operating efficiency.

Lower Tariffs

The tariff cuts on a number of minerals promulgated in the Geneva agreements were received by the affected elements in the mining industry with slight comment. This indifference is unquestionably due to the circumstance that most minerals are in short enough supply to make tariff currently of academic interest. Nevertheless, it is certain that a return to a more competitive world will make these reductions burdensome to many producers—unless a subsidy program is set up—and that pressure in Congress will result. As stated above we expect the political climate to become less and less favorable to tariff protection. As for the widely publicized escape clauses in the trade agreements, the past record of the State Department in this respect plus the added difficulty of rebalancing concessions made at round-table parleys, point to the futility of expecting help from this quarter. Apparently, industry must learn to live with lower tariffs, despite the obvious fact that nationalism dies hard.

Other Factors

The stockpiling program will doubtless continue throughout 1948 as a market-bolstering influence. Our own view is that, as the problem of security is better understood, stockpiling objectives will gradually grow to several billion dollars worth of material, rather than the few billion now contemplated. If Russia continues its intransigence and communists continue to make territorial gains, acceleration of the stockpiling program will be a natural result.

The extraordinary increases in freight rates, amounting to 25-30% in 1947, and with a minimum of 10% to be added in 1948, are bound to have a profound effect on domestic mining. These increased costs will undoubtedly contribute toward higher prices and, when competitive conditions return, may give an important advantage to water-borne imports.

Another factor with which the industry must reckon is the continued support by most of its organized workers of a communist-line leadership. Nobody can predict the harm which the propaganda of people thus zealously devoted to discord may do. No thoughtful person can overlook the fact that support of communist-line leaders by a non-communist rank and file is partly

a vote of no-confidence in management. Certainly, now that its right to express itself has been clarified, management should take steps to inform workers of its position and problems.

Public Interest

The publicity that has been given to the depletion of mineral resources, plus the new respect for raw materials that is growing in the public mind, imply that from now on the public and public officials will take a stronger interest in the mining industry. This means that from now on there will be more willingness in Congressional and official circles to consider the industry's problems. It also means that there will be more disposition to interfere in the industry's affairs. Thus, it is more desirable than ever that the industry should lend itself to educating the public on the industry's problems, now but poorly understood.

In conclusion, we reiterate that the industry has a fair prospect of enjoying a good year in 1948, certainly a better prospect than industry in general. Also, considering that mineral consumption is still expanding, there should be "room in the house" to accommodate both a desirable level of domestic production and increased imports. In other words, there is no fundamental basis for serious cleavage within the industry, either between domestic and international, big and little, or high and low cost operations.

Most Economists Predict Good Year

"Business is strong today, and it is going to be strong through the first half of next year. Beyond that, I am frankly up in the air."

Lionel D. Edie
Lionel D. Edie & Company

"We will have a rather sizable readjustment that will be of moderate duration, reaching its turning point within six to twelve months after the decline begins . . . It seems probable that some time in the next six months we are going to have this particular downturn."

Robert R. Nathan
Robert Nathan Associates

"I think the Federal Reserve index will go up gradually during the next year, reaching perhaps an average of 195 *in the first half of the year and* 200 *in the second half . . . . The country is entering a second and longer stage of expansion in manufacturing and distributing capacity to serve the market comfortably, as well as to install technological advances."*

Everett H. Hagen
Bureau of the Budget

"I estimate 200 (Federal Reserve Board) for the first and second half of 1948 and gross national product of $240 billion."

Louis H. Bean
U. S. Department of Agriculture

"I am inclined to think that there will be a moderate readjustment, which means a lowering of a good many of the figures. I can't make up my mind whether this will come in January or June."

Rufus S. Tucker
Economist, General Motors Corp.

"It seems to me that conditions spell for the future the same sort of general developments that they spelled a year ago, namely, sustained production, rising prices, and continuing maladjustments . . . From the income side we will continue to have a high level which will necessarily help to sustain high-level demand."

Bradford B. Smith
Economist, United States Steel Corp.

"While there will be an inability of consumer income and purchases to keep up with the increase in prices by late 1948, *I don't expect the recession to be anything but a moderate one, at least through* 1948."

A. D. H. Kaplan
The Brookings Institution

"Looking ahead through the first half of 1948, it seems to me that high-level demand and high-level production will continue . . . I wouldn't be surprised, however, to see it remain at a high level throughout the entire year."

Jules Backman
New York University

"We will have rising wholesale commodity prices, perhaps to the extent of 15% *to* 20% *between now and June; also a* 5% *to* 10% *rise in the cost of living. I think that thereafter there will be a slow decline."*

O. Glenn Saxon
Yale University

"The business boom can be expected to run on well through 1948. But unless important adjustments are made this year there is real danger of a severe slump in 1949."

Department of Economics
McGraw-Hill Publishing Co.

"The economists who expect a recession in the early part of 1948 *will turn out to be mistaken.*

"Perhaps the index of industrial production next year (1948) *will average almost* 200, *in comparison with about* 187 *which will be the average for* 1947."

Sumner H. Slichter
Harvard University

METALS
Review and Forecast

Gold

Unbalanced trade causes import curbs and record U. S. gold stock. Canadian subsidy and premium-price pressure worry Fund

DESPITE MUCH TALK about gold in 1947, it is impossible to call the year definitive in relation to the problems of the producing industry. On the positive side, the cost of recovery continued to mount and output continued low in most countries. On the negative side, a critical dollar shortage in international trade and the collapse of plans to restore sterling to convertibility provided evidence that the problems related to the ultimate stabilization of the world's currencies are far from settled. The connection of this latter situation to the monetary future of gold remained obscure at the year end. At that time, prospects seemed good for large scale U. S. aid to Europe that would add substantially to exchange resources and accordingly reinforce the prospects of maintenance of the exchange structure that has begun to function under the aegis of the International Monetary Fund. In the meantime, however, the depletion of reserves by a heavy movement of funds to the United States cannot be completely discounted. The wave of interest there has been in premium prices for gold and in gold subsidies during the year indicates that exchange structures have come under greater pressure.

Much of the year's background which relates to gold can be explained in terms of the great and apparently growing disparity between the United States and other countries in terms of mobilizable wealth. Attention has been centered on the impaired position of the countries which were war theaters and therefore had vital productive equipment destroyed in addition to suffering other disruptions of their economies. The difficulty in balancing, however, is not confined to them. The demand for United States goods was very great from all countries. When supplies began to ease in the United States, the expansion of foreign buying here became embarrassingly large, both for foreign countries and for us.

The increased excess of exports, along with a falling off in the share of the trade that was financed by relief and special credit mechanisms, resulted in proportionately larger cash payments to us. Thus, the dollar accumulations of foreign countries ran down rapidly and their gold reserves were drawn increasingly into the picture. Sales of gold rose from $800,000,000 in 1946 to $2,800,000,000 in 1947. At $22,754,000,000 on December 30, the United States gold stock has returned almost to its prewar peak. If we include the $688,000,000 that was contributed during the year as the United States gold subscription to the International Monetary Fund, the prewar record of $22,800,000,000 of October, 1941, is exceeded.

This marked gold flow is the more notable because of the elaborate preparations that had been made to forestall it. In the two preceding years, international agreement has been obtained on the constitution and by-laws of two new and highly specialized institutions —the International Monetary Fund and the International Bank. These organizations began to operate in 1947 with large amounts of capital contributed in gold and national currencies by the many participating countries. While member countries were able to draw on their resources to some extent during the year, some commentators have expressed surprise that the Fund and Bank were unable to intervene more effectively, but the surprise probably reflects underestimation of the extent of the crisis and the speed with which it arose.

How Available Are Resources?

It is reasonable to inquire how significant the loss of gold and dollar assets by foreign countries in 1947 was in relation to their total holdings. Estimates compiled during the year in the Government for the Senate Finance Committee show that foreigners, as of June 30, had a total of approximately $14,000,000,000 in gold and $5,300,000,000 in short-term dollar assets. Deducting for their losses during the second half of the year, they might be said to hold around $18,000,000,000 at the year end. Although this total is impressive, it is debatable how much could be counted as available to bolster a declining exchange position. The report to the Committee says "most of these

Gold Production by Principal Reporting Areas

(In millions of ounces)

Principal reporting areas	1947[1]	1946	1940	Percentage Change: 1946-1947	Percentage Change: 1940-1947
North America					
United States	2.4	1.5	4.9	+64.4	—50.6
Canada	3.0	2.8	5.3	+ 7.2	—42.9
Mexico	0.4	0.4	0.9	+ 4.3	—50.4
Central and South America					
Colombia	0.4	0.4	0.6	— 7.8	—36.2
Chile	0.2	0.2	0.3	— 6.9	—37.3
Nicaragua	0.2	0.2	0.2	+15.9	+36.1
Africa					
Union of South Africa	11.0	11.9	14.0	— 7.7	—21.6
Rhodesia	0.5	0.5	0.8	— 4.2	—36.9
Gold Coast	0.6	0.6	0.9	+ 9.1	—28.0
Belgian Congo	0.3	0.3	0.6	+ 3.8	—40.2
Australia	1.0	0.8	1.6	+26.4	—36.6
British India	0.2	0.1	0.3	+41.2	—36.2
Total principal reporting areas	20.4	19.9	30.4	+ 2.8	—32.9
Other countries excluding USSR (partly estimated)	1.7	1.6	6.6	+ 8.9	—74.3
Total	22.1	21.5	37.1	+ 3.2	—40.3

[1]Estimate based on incomplete data.

resources constituted reserves needed by their holders to finance the current flow of international trade or to back their currencies." The statement includes the following comment on monetary reserves in general:

"In view of the general abandonment of the gold standard and the adoption of managed currency systems, a gold reserve is no longer technically required to meet gold payments within any country. In these circumstances, monetary reserves may logically be considered not as internal reserves but as funds (supplemented, to a limited extent, by the possibility of drawing upon the International Monetary Fund), for meeting contingencies in international payments and for the stabilization of exchange rates. It is clear that the amount of international currency a country needs is not directly related to the volume of its central bank's sight liabilities or even to the amount of its domestic money supply (currency plus demand deposits). While the traditional reserve ratios of central banks are open to this technical criticism, they nevertheless command the attention and respect of the general public in the countries concerned. Hence governments continue to regard seriously any decline in the reserve ratio and to impose increasingly stringent restrictions on foreign payments whenever this ratio tends to fall below what is customarily regarded in the country concerned as a 'safe' or 'minimum' level."

These reported holdings are understood to take no account of hoarded gold which, in some countries, is estimated in very large terms. Considerable publicity has been given to estimates of the amount of such gold held in France which run between 2 and 3.4 billion dollars.

Regardless of the fact that, under pressure, considerable amounts of gold and dollars might still be exportable, a number of countries gave notice during 1947 that they considered the depletion of their reserves critical enough to call for remedial measures. Sweden, Canada, Mexico, and Argentina, all of which escaped direct war damage, may be cited in this group. Significantly, all of them undertook to improve their situation by direct measures—by restricting imports —rather than by currency depreciation. With their national incomes still high and an urgent need for goods, there could be no certainty that depreciation of their currencies to any reasonable level would exert the necessary restraint on imports.

Gold Price Pressure

Against this background, the prospects for a general increase in the gold price tend to remain negative. However, the subject continues to receive attention. A reason for the interest can be discerned in the worsening position of gold producers in a situation in which commodity prices, as measured by the U.S. index, have moved forward some 14%. Another reason, which has a certain appeal for those not directly concerned with producers' profits, is based on the concentration of gold production in the British Commonwealth, a fact which has led them to suggest that a higher price for gold might help in solving the Empire's dollar shortage. The subject of gold loans has been broached in several different aspects. South Africa has made a large gold loan to the United Kingdom. The possibility of a gold loan to Europe by the United States as an aid in rehabilitating local currencies and bringing out hoarded gold badly needed for stabilization has also been aired.

Late in the year there was also a surprising development in the Canadian production situation which made a considerable stir in conservative ranks. The Dominion Government, having regard to the importance of gold mining in the national economy, and desiring to reconstitute depleted monetary reserves, has decided to pay a subsidy to gold mines for three years dating from Dec. 1. The subsidy will be half the difference between their current production cost and $18 per fine ounce, and will be paid on output in excess of two-thirds of production in the year ended June 30, 1947. The significance of the $18 floor seems to lie in its semblance to the average cost of production in the Ontario industry in 1941, the year in which output, not yet influenced by the entrance of the United States into the war, reached a peak of 5,345,000 oz. Subsequently, a low of 2,651,000 oz. was recorded in 1945 and after slight improvement in the past two years, it will probably reach 2,830,000 oz. in 1947.

Subsidy Worries Fund

When the idea of an exchange stabilization fund based on gold was developed in 1944, there was comment that adaptation of gold to commodity prices might result from an international agreement which made much of a gold base although it was intended to reduce dependence on gold as an exchange medium between countries. For this reason, the reception accorded the Canadian plan by the International Monetary Fund is of special interest. The Fund had begun operations early in the year on the basis of par values in terms of gold that had been declared for the currencies of most of the world's principal trading countries. In a careful statement, it said the Canadian plan was "not inconsistent" with the general policy of maintaining exchange parities but it insisted on the right to review members' proposals for subsidies with a view to

"the circumstances in each case." Concern with the maintenance of exchange stability was stressed as well as the possibility that subsidies might undermine this ideal, particularly if they were to cast widespread doubt on the gold value of money in member countries.

In the United States, Secretary of the Treasury Snyder issued a statement on behalf of the National Advisory Council which welcomed the expressed intention of the Fund to keep under review the gold policies of members. This statement said the United States, as the largest gold-buying country, would "view with disfavor any tendency for countries to become dependent on subsidized gold production as a solution to the problem of arriving at and maintaining equilibrium in their balances of international payments. In the view of the National Advisory Council, there are no grounds which would justify instituting a subsidy to encourage the production of gold in this country [i.e., the United States]."

Both of these statements imply concern with the possible spread of the subsidy idea and tacit acknowledgment of the existence of a degree of arbitrariness in the present exchange structure. However, the Canadian experiment is too recent to have gathered a following. At the other end of the British Commonwealth, in the Union of South Africa, which is the world's largest gold producer, the Reserve Bank was insisting as late as August that the ultimate interest of the gold mining industry lay in the maintenance of the monetary status of the metal. Taxation of the gold mines, which is very important there, may be the vehicle of adjustment if improvement of the industry's position should be necessary. Some concessions were made in this direction during the year, but because of the strike of European workers in the early months, the output for 1947 is lower than for 1946. The Australian industry, which has done better in point of output, has been given the benefit of elimination and of the bullion tax imposed during the war years. This is reported to have made a difference of $2.82 per fine ounce.

Premium-Price Problems

In the Philippine Republic, where severe damage was inflicted on the industry in connection with the occupation by Japan, recovery has only begun to show a comeback and the case for a higher gold price has taken a different turn. Producers there have contended that they should be permitted to sell in the highest market—the free markets of the Far East—so as to help them recoup. This posed a problem for the country because of the importance of the industry to exports in general. It has been solved by permitting free sale at home, i.e., in the Islands. Export is licensed and prohibited at more than $35 but there are reports that the export control is not very effective.

The data available on prices in the free or black markets do not provide any evidence of a clear trend, largely because of the influence of political unsettlement and the difficulty of conversion where there are controlled exchanges which are only nominal in their effect on transactions. In India, the open-market rate was as high as 117¾ rupees per tola ($95 per fine ounce) in June but it had fallen to 99½ rupees ($80) by Oct. 15. An effort was made by the International Monetary Fund during the year to dry up the supplies to these high price centers by a request to Fund members to refrain from international transactions at premium prices. Many countries acceded to the Fund's request, among them the United States, which amended its gold regulations so as to ban from the traffic some gold which had been reported getting into it from exports for industrial and artistic purposes and from refinery sales based on imported ores. Switzerland, not a member of the Fund, stopped the domestic sale of gold coins after the demand became intense with the suspension of sterling convertibility. This sale had been considered an important source for Europe and the Near East.

Silver

Industrial demand now considerably above its prewar level. India abandons use of the metal for coinage purposes

Dickson H. Leavens
Colorado Springs, Colo.

THE PRICE OF SILVER showed considerably greater fluctuations in 1947 than in recent years. Special wartime factors have largely disappeared and industrial uses have furnished the greatest part of the demand. The large potential demand in India for ornaments and hoarding has been removed from the world market since March by an embargo on import of the metal. During the year, another important step in reduction of monetary use has been taken by India's complete abandonment of silver for coinage.

During the year, the price of United States newly-mined silver has been determined, of course, by the Treasury's buying price of 90½c. fixed by the Act of July 31, 1946. The price of foreign silver in New York, which had begun to fall from the 90½c. level early in December, 1946, continued downward to a low of 70¾c. per ounce, 0.999 fine, on Jan. 20, as industrial inventories had been built up and that demand slackened. Toward the end of February, the price strengthened and reached the year's high of 86¼c. on March 6. During the spring, it fluctuated near 70c. but dropped to the year's low of 59¾c. on June 20. The trend was slightly upward during the summer, and from early November the price was steady at 74⅝c.

In London, the official price opened at the year's high of 55½d. per ounce, 0.999 fine, and remained at that point through January in spite of the drop in New York. Early in February, however, Bank of England control of the price at which silver could be sold to authorized users (that is, industrial users and manufacturers of silver articles for export) was removed and the official price dropped to 44d. or approximate parity with New York. It continued to follow New York fluctuations, reaching a low of 37d. on June 26, and settling at 45d. from Nov. 6 to the end of the year. Manufacturers of silver

Silver Production

(American Bureau of Metal Statistics)

Production of silver by the following five countries embraces a substantial percentage of the world's total. Detailed statistics on world production not yet available. Figures are in troy ounces.

	United States	Canada (a)	Mexico (b)	Peru (c)	Australia (d)
1945	29,332,000	12,943,000	61,000,000	12,998,000	7,500,000
1946	21,377,000	12,544,000	48,298,000	14,467,000	6,572,000
1947:					
January	2,464,000	768,000	4,200,000	500,000	703,000
February	3,713,000	896,000	4,000,000	825,000	588,000
March	3,250,000	1,048,000	4,300,000	1,250,000	848,000
April	2,730,000	852,000	4,200,000	1,290,000	797,000
May	3,896,000	930,000	4,200,000	1,250,000	525,000
June	2,746,000	1,085,000	4,300,000	1,380,000	554,000
July	1,924,000	1,029,000	4,400,000	1,375,000	620,000
August	2,594,000	1,062,000	3,600,000	1,070,000	634,000
September	2,180,000	924,000	4,100,000	1,190,000	599,000
October	3,243,000	1,094,000	.....	.....	.....

(a) Mostly refined in Canada but includes silver content of products exported. (b) Estimated in small part; includes silver content of products exported. (c) Partly estimated. (d) Estimated on the basis of lead and copper desilverized in Australia, ex silver in products exported.

goods for sale within the United Kingdom had to continue to buy in the "free silver" market, where the price was higher, moving in sympathy with the Bombay parity.

World statistics on the production of silver, so far as available, are given in the accompanying table.

Foreign silver has been imported into the United States at an average rate of 7 or 8 million ounces per month, about half of this from Mexico and Canada, and the rest from other producing countries or holders of stocks. This apparently has been ample to supply the industrial demand.

Before the embargo, considerable silver arrived in Bombay from Hong Kong, consisting of coins and bullion hoarded in China during the war years. Also about 12 million ounces was shipped from Europe to India by Belgian interests, who were able to make profitable arbitrage transactions because of the wide divergence of silver prices and exchange rates in various markets.

Treasury Stocks

All United States newly-mined silver naturally went to the Treasury. This resulted in an increase of bullion in the Silver Certificate Reserve from 1,478 million ounces Jan. 1 to 1,498 million ounces Dec. 31. Silver bullion held at cost in the General Fund ("free silver") showed a net decline from 197 to 184 million ounces during the same period, the result of the addition of seigniorage silver and the withdrawal of silver for subsidiary coinage. Subsidiary-coinage stocks (chiefly in circulation) increased from 915 million dollars Jan. 1 to 936 million dollars Nov. 30.

Of the Treasury bullion the quantity outstanding in loans to the Defense Plant Corporation (for bus bars, etc.) was reduced from 878 million ounces Jan. 1 to 775 million ounces Dec. 31. This silver is included in the bullion stock mentioned in the preceding paragraph and its return is only a shift of physical location. Lend-lease loans of over 400 million ounces to foreign governments were still outstanding; the return of these will increase the quantity of "free silver" unless otherwise allocated.

Outside the United States the only considerable monetary user of silver during the year was Mexico, which planned to use about 2 million ounces per month for the coinage of 1-peso and 5-peso pieces to replace some of the paper currency in circulation.

An important stage in the decline of the monetary use of silver which has been going on for a generation was marked by the decision of the Indian Government in April to coin rupees of nickel instead of silver. Production of the new coins has been started and silver realized from the withdrawal of the old coins is being accumulated to return to the United States the 226 million ounces borrowed during the war. This represents the final step in abandonment of silver coins by a country which only twenty years ago had over 1,000 million ounces of the metal in that use.

Factors in the Demand

Now that the purely wartime factors are moving out of the picture, it may be of interest to survey briefly the major elements in the world demand for silver in the past and future. Before World War I the principal uses of the white metal were as follows: 1. For the coinage of rupees and subsidiary coins in India. 2. For currency in China under a silver standard. 3. For subsidiary coins in Western countries. 4. For ornaments and hoards in India. 5. For silverware and industrial uses in Western countries. These factors varied absolutely and relatively to each other from year to year, depending on conditions in the countries concerned, but together were enough to take care of the supply at a price. In the last thirty years, however, there have been considerable changes in the intensity of these uses.

1. World War I produced an enormous demand for rupee coinage in India, which was met by Pittman Act silver and large open-market purchases. Postwar deflation and increasing popularity of paper currency made the stock of rupees redundant and from 1927 to 1937 more than 200 million ounces was melted and sold, thus turning the Indian monetary system into a supply instead of a demand factor. India continued to coin silver subsidiary coins but in 1940 reduced the fineness of them and of the rupee from 11/12 to 0.500, thus producing more surplus metal. The final abandonment of silver in 1947 is reported above.

2. In normal times the Chinese demand was perhaps the most flexible. Silver, being real money in China, could always be shipped there, just as gold could always be shipped to a gold-standard country. At times it flowed out to other uses, but by 1933 there was about 1,700 million ounces in monetary use. The increase in the price of silver from 1933, brought about by American legislation and policy, led to the abandonment of the silver standard by China and the dumping of large quantities of her silver on the market. Although there are probably between 500 and 1,000 million ounces of silver still hoarded in China, and some of this is in use in black-market transactions as a protection against the astronomical inflation of the paper currency, it does not seem likely that China will revert to the silver standard or even to the permanent use of silver currency.

3. The third factor, subsidiary coinage in Western countries, has

been greatly modified since World War I. In 1920, the United Kingdom reduced the fineness of her coins from 0.925 to 0.500, and in 1946 abandoned silver entirely. In the 1920's other countries reduced the fineness or changed from silver to cheaper metals. The same tendency is likely to continue for reasons of economy. On the other hand, the United States since 1933 has increased its monetary stocks (predominantly in bullion rather than coin) from 640 million ounces to over 2,700 million ounces, to which will be added eventually more than 400 million ounces due on Lend-Lease returns. Under present laws American absorption will continue as long as other demand does not send the price above 90½c. Mexico and Canada may also continue to use some for their own production.

4. The Indian demand for ornaments and hoards has often been of great magnitude, as high as 100 million ounces per year, but has varied greatly with economic conditions in that country, and probably has a long-time downward tendency as other investment opportunities become available and acceptable to her population. The present high price in India is the result of this demand, inadequately satisfied by Lend-Lease and other supplies of silver. It is likely to continue to be a factor for many years, although at present it cannot directly affect the world market since the import of silver is forbidden.

5. The last factor is the demand in Western countries, now chiefly the United States, for silverware and industrial uses. During the 1930's this was of the order of 50 million ounces per year for the world; it increased greatly in wartime to 140 million ounces for the United States alone in 1945. In 1946 it dropped to 105 million ounces and has probably been somewhat less in 1947.

Thus two of the historical factors in the demand for silver are gone, probably never to be revived. The monetary demand is now of importance only in the large producing countries. There remain the large potential Indian demand, at present ineffective because of the insulation of that market, and the industrial demand, now considerably above its prewar level. These two uses will be the principal ones to absorb current foreign production and such other supplies as may come on the market.

Copper

Peacetime Use in United States Sets New High—Outside Factors Important in 1948

H. H. Wanders
Market Editor

THE BEGINNING OF 1948 found copper producers again questioning the ability of consumers to repeat on an extraordinary performance. Consumption of copper in the United States, whether measured in terms of deliveries to consumers or in tonnage that actually went into production at fabricating plants, established a new peacetime high in 1947.

Deliveries of refined copper to domestic consumers during the last year totaled 1,383,666 tons, exceeding the previous high for a peacetime year—1946—by 122,745 tons. The prop that supported the world market in the metal was the high rate at which copper was absorbed by industry in this country. The heavy demands of 1947 resulted from the boom conditions that prevailed in the domestic economy, along with an extension of the movement to build up inventories and fill the pipelines with raw materials, semi-manufactured goods, and finished products. During 1947, the wire and cable industry absorbed about 60% of the total amount of copper consumed, with the brass mills, including production of rolled copper products, accounting for 40%. This trend in consumption is expected to continue in 1948.

In a more or less free market, the average price of copper in the domestic trade for 1947 was 20.958c. per pound, f.o.b. refinery, which compares with 13.820c. in 1946. The fluctuations in the *E. & M. J.* daily averages for 1947 for domestic and export copper, f.o.b. refinery, in cents per pound, were as follows:

	Open	High	Low	Close
Domestic	**19.225**	**23.300**	**19,225**	**21.200**
Export	**19.800**	**23.700**	**19.675**	**21.425**

An upward movement in prices that occurred early in 1947 had its origin in uncertainty over the position that the Government would take in terminating its allocation program, which was also tied to the problem of what to do about the 4c. import tax on copper. Both producers and fabricators were convinced that substantial importations of copper would be required for some time to come, because there were no indications of a recession in demand. In the event that the import tax were to remain on the statute books, it was argued that the market price would have to rise, possibly to the extent of 4c. per pound.

Pending developments in connection with the tax issue, consumers came into the market for all of the copper that they could get. The fever to accumulate copper also spread to Europe. Deliveries of copper to domestic consumers in the first month of the year increased sharply to 151,948 tons, of which total about one-third consisted of metal released from the Government's dwindling stockpile. At the beginning of the year, it was estimated that the Office of Metals Reserve had some 150,000 tons of foreign copper available for allocation, a small tonnage weighed against the heavy demands of consumers that threatened to deplete the entire surplus in less than three months.

In the midst of this confusion, the Reconstruction Finance Corporation announced that to comply with the Government's policy of avoiding subsidized sales, the price of copper available for allocation to domestic consumers would be adjusted to cover the average cost, plus duty, or the prevailing market price, whichever was higher. This move, announced late in February, resulted in a selling basis for such copper of 21½c per pound, Connecticut Valley.

Suspends Import Tax

Agitation for the temporary suspension or waiving of the duty increased in intensity. Early in March most producers and consumers became convinced that favorable consideration of the pro-

Summary of 1947 Copper Statistics

Reported by Members of Copper Institute

(Figures in Tons)

UNITED STATES

Production:	Jan.	Feb.	Mar.	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Totals 1947
Crude, primary	71,260	68,936	75,415	75,840	77,028	73,615	72,498	75,547	73,581	69,127	64,918	73,382	871,147
Crude, secondary	7,053	5,624	9,030	13,253	14,247	8,719	6,654	7,754	10,341	7,688	7,616	7,211	105,190
Totals	78,313	74,560	84,445	89,093	91,275	82,334	79,152	83,301	83,922	76,815	72,534	80,593	976,337
Refined	96,729	97,598	95,964	104,596	108,536	103,474	94,610	88,122	92,146	108,277	97,525	108,816	1,196,393
Deliveries, refined	151,948	122,157	123,382	117,557	118,120	116,678	109,822	96,374	95,640	112,310	106,232	113,446	1,383,666
Stocks, refined	96,515	88,368	83,736	86,496	84,560	82,542	77,773	77,212	80,113	74,507	66,622	74,832	.....

OUTSIDE UNITED STATES

Production:	Jan.	Feb.	Mar.	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Totals 1947
Crude, primary	102,924	95,650	100,197	112,438	116,182	102,867	94,948	85,780	105,244	108,266	101,655	103,269	1,229,420
Crude, secondary	968	440	526	381	429	382	953	839	988	1,036	531	1,522	8,995
Totals	103,892	96,090	100,723	112,819	116,611	103,249	95,901	86,619	106,232	109,302	102,186	104,791	1,238,415
Refined	88,264	81,524	74,938	94,754	95,257	88,022	73,950	73,673	88,882	87,548	82,726	87,318	1,016,856
Deliveries, refined	63,981	83,670	73,121	94,209	80,834	74,355	68,827	63,370	74,093	79,277	87,398	78,716	921,851
Stocks, refined	126,920	129,207	127,499	125,200	136,469	141,902	138,339	138,639	145,581	154,590	148,824	143,979	.....

Copper Production in 1943-1947

Production of copper by various countries reporting regularly to the American Bureau of Metal Statistics, figures in short tons:

	United States (crude) (a)	Canada (refined)	Chile (bar)	Peru (crude)	Mexico (crude)	Rhodesia (crude)	Australia (crude)
1943	1,215,500	251,495	538,509	31,183	44,442	276,955	29,500
1944	1,088,000	256,244	539,831	29,013	39,304	246,498	34,500
1945	869,138	227,346	509,331	27,849	59,729	215,572	29,000
1946	642,124	167,858	395,283	21,309	55,751	204,922	20,494
1947							
Jan.	78,313	13,283	41,697	.....	4,875	21,827	460
Feb.	74,560	11,426	38,447	967	5,151	20,921	540
Mar.	84,445	13,665	40,203	2,241	5,205	13,313	1,560
Apr.	89,093	16,757	40,741	2,314	5,694	21,370	910
May	91,275	18,732	41,752	1,951	5,800	19,610	1,440
June	82,334	18,708	37,754	1,850	5,377	17,685	1,700
July	70,152	19,792	34,426	1,827	5,633	11,102	1,730
Aug.	83,301	17,984	26,964	1,544	5,099	12,867	1,890
Sept.	83,922	17,663	35,351	1,610	4,604	17,622	.....
Oct.	76,815	18,163	37,657	1,904	4,144	20,820	.....
Nov.	72,534	17,981	.....	1,761	4,597	20,752	....
Dec.	80,593	.....	.....	.....	.....	.....	.....
Total	976,337	.....	.....	.....	.....	.....	.....

(a) Blister or converter copper for 1943-46; beginning 1947, by Copper Institute as "mine or smelter production or shipments, and custom intake, including scrap." Does not include production from smelting of imported ore. By crude copper is meant the copper content of blister or converter copper as originally produced in the several countries.

posal would come shortly. The House of Representatives voted on March 12 to suspend the import tax on copper for two years, or until March 31, 1949. The Senate approved the measure to suspend the tax on April 21, and President Truman signed the bill on April 29.

With the struggle over the duty out of the way, consumers gradually took a more rational view of the supply-demand situation. Nevertheless, the market did not return to a flat 21½c. basis until June.

In reference to the tariff, it should be recalled that in the 23-nation agreement at Geneva, announced late in the year, the import duty on copper was reduced to 2c. per pound. This rate will remain inoperative until after March 31, 1949. Most authorities agree that the temporary suspension of the duty will be continued in the event that consumption in 1949 remains substantially higher than the available domestic supply. The price level also will have an important bearing on tariff policy.

U. S. Mine Output Up

A preliminary estimate by the Bureau of Mines placed mine output of copper in the United States in 1947 at 860 000 tons, a 43% gain over that of "strike-harassed 1946." Production of crude copper in this country from mine production and scrap treated by custom smelters totaled 965,000 tons. Deliveries of 1,383,666 tons of refined copper to consumers would indicate that fabricators absorbed approximately 400,000 tons of foreign copper in addition to the supplies available from domestic sources during 1947.

The following table of deliveries of refined copper to domestic consumers and estimated consumption based on statistics compiled for the fabricating division of the industry, by months, indicates fairly accurately how the industry conducted itself during the year. The figures point to some over-buying in the early months, then a slowing up in the uncertain summer period, and renewed activity as it became apparent that business volume would continue at a high level over the last quarter of 1947 and perhaps well into the first half of 1948. The figures follow, in tons:

	U. S. Deliveries	U. S. Consumption
January	151,948	139,318
February	122,157	118,705
March	123,382	115,287
April	117,557	188,559
May	118,120	113,229
June	116,678	104,156
July	109,822	87,172
August	96,374	96,554
September	95,640	108,471
October	112,310	121,080
November	106,232	105,704
December	113,446	110,142
Totals	1,383,666	1,338,322

Subsidy Payments End

Expiration of the Premium Price Plan in midyear failed to influence the market one way or the other. In relation to total output, the decline in production that occurred because of the demise of the plan was slight. The fact that the price advanced sharply after decontrol ended in 1946 eased the cost-price problems of most high-cost mines considerably. As of the end of October, the Bureau of Mines pointed out that 16 mines that produced some copper had closed because of the expiration of subsidy payments. Copper production at these mines averaged 540 tons a month in 1946 and 700 tons a month in 1947. The Bureau cautioned that various factors tend to complicate determinations as to the cause of mine closings, and it was implied that final judgment on the effect that expiration of the subsidy plan would have on the industry should be withheld until some later date.

During 1947, the Copper Institute released statistics on production, deliveries and stocks covering the operations of its members situated outside of the United States as well as those located in the United States. Full membership in the organization accounts for about 92% of the world's production of copper. Production of crude copper by the group amounted to 2,214,752 tons in 1947, an increase of about 400,000 tons over 1946. Production no doubt would have expanded to a greater extent except for some work interruptions, transportation difficulties and fuel shortages. However, the work stoppages in 1947 were of little consequence compared with those of the preceding year. Most of the gain in production occurred in the United States, though an upward trend was recorded for Canada, Chile and Rhodesia. European production increased slowly.

Though industrial recovery in Europe was spotty and exasperatingly slow, the British continued to absorb substantial quantities of copper. The bulk buying program was continued. Resumption of trading on the London Metal Exchange as the year ended appeared to be remote. Consumption of virgin copper in the United Kingdom in 1947 amounted to 350,000 tons, which contrasts with 325,000 tons in 1946 and 288,500 tons in 1945. As in prior years, large tonnages of scrap were consumed.

Demand for copper from various European countries was fairly active throughout the year, but the volume of business suffered because of the shortage in dollar balances. The need for dollar exchange was so great that some European production was shipped to the United States to obtain funds for more vital commodities and equipment. Acceptance of the Marshall Plan by Congress will be viewed as a favorable development, for without this aid it appeared doubtful whether purchases of copper by European countries where dollar credits were essential could be maintained at the 1947 rate.

Turning to the outlook for 1948, it is safe to assume that a recession of consequence is unlikely to occur in a period during which marked deficiencies exist in key industries.

Pipelines must be filling up, and demand for copper that could be traced to activity of this sort in all probability will recede. To expect consumption of copper in the United States to drop moderately from a 1947 average of around 114,000 tons a month is hardly more than being realistic. However, with the Government ready to accumulate surplus copper for its stockpile, the volume of new business should prove sufficient to maintain the price at around the 21½c., Connecticut Valley basis.

World production of copper may increase. Normally, this would tend to make consumers cautious in placing new business. But there are no signs of a return to normalcy in 1948. When deflation finally comes to some of the highly inflated agricultural products, as cotton and the grains, it is probable that the entire price structure will return to a reasonable level. In brief, outside factors, as worldwide good crops, are likely to exert a greater influence on the price structure of the copper market on some future date than the internal problems of the industry.

Zinc

Price, unchanged for entire year, not likely to decline in view of Government buying for stockpile. May go higher.

Charles R. Ince
Manager of Metal Sales
St. Joseph Lead Co., New York

AFTER FIVE YEARS of price control, 1947 was the first year in which a free market for zinc was enjoyed throughout. It was, moreover, the only year in which the price of the metal, excluding the controlled markets of the war years, remained unchanged. The St. Louis price for Prime Western zinc went to 10½c. per pound Nov. 12, 1946, shortly after the demise of the OPA, and has remained there ever since.

One possible explanation of this phenomenon is that, while there was not a Government-controlled market, the metal nevertheless was not operating in a completely free market, that is, one solely responsive to the laws of supply and demand. A few of the factors that precluded a full return to a "free" market were: the Premium Price Plan in the first half of the year; releases of zinc from Metals Reserve stockpile; and, in the last quarter, Government purchasing for permanent stockpile. While the price might have advanced if the Office of Materials Distribution had not released metal from the Metals Reserve Co. stockpile in the first half, when demand was in excess of available supply, it is also possible that Government purchasing for

U.S. Slab Zinc Statistics

Slab zinc production in the United States, including production from foreign ores, according to the American Zinc Institute, in tons:

	Production	Shipments				Stock at End
		Domestic	Export	Gov't Acc't	Totals	
1941	863,955	751,276	106,195	.....	857,471	24,066
1942	929,770	733,918	151,650	.....	885,568	68,268
1943	971,873	831,430	56,208	.....	887,638	173,510
1944	901,332	830,334	6,988	.....	837,322	237,520
1945	799,520	762,925	9,422	5,302	777,649	259,391
1946	759,346	714,292	66,638	62,007	842,937	175,800
1947:						
January	72,332	67,211	7,584	.....	74,795	173,337
February	65,198	65,356	10,718	.....	76,074	162,461
March	75,376	67,325	8,463	.....	75,788	162,049
April	73,891	61,715	10,528	.....	72,243	163,697
May	73,970	58,827	11,976	.....	70,803	166,864
June	70,990	52,390	11,137	.....	63,527	174,327
July	69,128	44,801	14,936	.....	59,737	183,718
August	66,852	52,122	5,487	31,705	89,314	161,256
September	67,867	50,558	10,285	31,706	92,549	136,574
October	71,745	57,564	8,096	63,386	129,046	79,273
November	69,682	59,154	10,125	10,510	79,789	69,166
December	70,996	61,258	7,970	2,923	72,151	68,011
Totals	848,027	698,281	117,305	140,230	955,816	.....

permanent stockpile later in the year when consumption was running well below production, prevented a decline in price. Under such circumstances, it is difficult to say what the true value of zinc is today. About all one can do is to analyze the supply-demand picture and try to guess what might have happened or will happen with the artificial factors removed.

Smelter Capacity Limits Ore Output

So far as supply goes, it appears that the limiting factor was smelter capacity, as domestic ore production plus available foreign supplies were ample to take care of smelter requirements. Domestic mine production averaged 56,200 tons a month of recoverable metal until the end of the Premium Price Plan in June, and dropped to around 48,000 tons per month thereafter. This production, plus imports of around 25,000 tons of zinc content in concentrates per month, has been sufficient to take care of smelters which averaged a little over 70,000 tons of metal output monthly in 1947.

Smelter requirements declined somewhat at the end of the year, as two retort smelters closed down at Danville and Langeloth. This reduction in output will probably be offset in 1948 by expansion at three smelters. The continued availability of foreign ore for supplementing domestic output depends on the requirements of foreign smelters, whose steady improvement of the previous year was retarded due to fuel shortages. If they do resume expansion and require more of the world's concentrates, thus competing with our domestic smelter purchases, the metal they produce will take care of more of the world demand, thus displacing some of our export business.

Domestic metal production of approximately 850,000 tons in 1947, plus imports of around 70,000 tons, appears to have been more than enough to take care of domestic requirements of about 800,000 tons and allow exports of 100,000 to 110,000 tons. Evidently, the surplus was offered to the Government's permanent stockpile as there was no appreciable increase in smelter stocks. Government purchasing for permanent stockpile will probably be an important factor in the future of the market. Not only has surplus current output been absorbed but also substantial tonnages of Metals Reserve stockpile. Whereas Metals Reserve stocks Jan. 1, 1947 amounted to 145,000 tons, on Nov. 30 they totaled only 26,000 tons. Thus the buffer, available earlier this year when demand exceeded supply, is substantially reduced.

Domestic consumption showed substantial increase over 1946. Latest Government statistics and industry reports indicate only one exception to a general improvement, namely, the brass mills and ingot makers. The galvanizing industry, as usual, was the largest consumer, accounting for at least 350,000 tons, as compared to 320,000 tons in 1946. Here the biggest increase was in the tube and pipe field and in job galvanizing, although galvanized sheet, as reported by the American Iron and Steel Institute, showed an increase of a little over 10%. Zinc-base die castings continued their upward trend in 1947, the consumption for this purpose being around 220,000 tons of Special High Grade zinc as compared to a consumption of 205,000 tons in 1946.

The brass mills and ingot makers, after holding their own pretty well in the first half, took considerably less in the third quarter and ended the year with a consumption of a little over 100,000 tons, a drop of about 30%. Rolling mills, zinc oxide and miscellaneous uses accounted for the balance, which was about equal to that of the previous year with the possible exception of the zinc rollers. The latter showed a slight decline as their export business dropped, due to competition of foreign fabricators and shortage of dollars abroad.

Future Looks Good

As for the future, there is no reason to expect a decline in activity in any of the consuming industries unless there is a recession in business which appears not to be expected in 1948. Some of the industries may well show an appreciable increase. The galvanizers, if steel is available, could easily top the 350,000 tons of 1947. The die casters, so closely allied to the automotive industry, could top 1947 and run as high as 240,000 to 260,000 tons, if Special-High-Grade metal is available. The brass mills and the ingot makers, having absorbed large quantities of scrap which flooded their plants in the third quarter in anticipation of lower metal prices, are in a position to expand their consumption of primary metals.

Assuming smelter production in 1948 at about the 1947 rate of 850,000 tons, since shutdowns will probably be offset by expansions at other plants, and imports of 70,000 tons, which should be maintained if not increased owing to dollar-hungry shippers, there should be enough zinc to take care of domestic consumption and allow 110,000 tons of exports with a little to spare. Among the major unpredictable factors is the possibility of an export market continuing at over 100,000 tons a year. This would appear to be tied in with the fate of the Marshall Plan. However, there is still every indication that any surplus, whether from drop in exports or lack of domestic demand, would be purchased by the Government for permanent stockpile. Under such circumstances, it is difficult to see how there could be a decline in the price of zinc in the coming year. With the world facing further inflation, it might very well move upward.

Lead

Highest price in history stimulates search for new deposits. Output of secondary metal sets new record

Robert Lindley Ziegfeld
Secretary
Lead Industries Association

SUDDEN READJUSTMENT to almost completely free market conditions, after about six years of rigid government controls and subsidies, naturally presented the lead industry with a number of complex problems in 1947. That these were met with reasonable success is shown by the larger supply of lead available and the steadiness of the market after it found its level.

Not until November, 1946, was the price ceiling removed. In December following, government controls over the end uses of lead were discontinued. Premium price payments to high-cost mines were continued until June 30, 1947. So it is only a short while since the Government got out of the lead business. Export controls alone continued throughout the year.

Price 15c. from March 4

The ceiling price in November, 1946, at the termination of OPA was 8.25c. New York. As soon as the ceiling was lifted, lead began to advance and seek its natural level. By Jan. 1, 1947, the price was 12.-55c per lb., the highest in history, exceeding the previous high of 12.-25c., reached in 1917 during World War I. The advance continued until March 4, when lead reached 15c., where it remained for the rest of the year.

At 15c., miners received little or no premium under the holdover wartime Premium Price Plan which was operative until June 30. In August, the President vetoed the Allen bill providing for extension of subsidies for two years. On the whole, the veto had a beneficial effect on lead. A Bureau of Mines study, released in December, revealed that only 51 mines producing some lead had shut down since the end of the Plan. These produced only about 600 tons a month. In most cases, they shut down because they failed to get premiums on zinc, which they also produced. Yet mine production in October was the highest for any month since April. In the Tri-State district, which was most affected by the end of premiums because of its heavy zinc output, lead production was several hundred tons higher in October than the monthly average in 1946 when subsidies were received. In other words, lead mines that were profitable under the Premium Price Plan apparently were profitable also without subsidies in a 15c. lead market.

Probably the most serious hindrance to lead production in 1947 was the inadequate labor supply, mainly at the Western mines. Yet this situation improved, despite the usual summer set-back. By the end of November, the lead mines were short only 1,100 men, the smallest number since the war and less than half of the shortage experienced the year before. During the spring seasonal decline, the shortage was about 2,200 men, compared with more than 3,000 men in the spring and summer of 1946.

Secondary production established a record of about 450,000 tons in 1947. The high price brought scrap out of hiding places. The rate of secondary production was lower in the second half, but nevertheless held up well. Production from scrap actually exceeded that from domestic mines by a good margin.

Imports were high, 205,000 tons, exceeding those of 1946 by 38,000 tons. This probably resulted from the ending of informal agreements with the United Kingdom to limit our imports of foreign lead in 1946 when the government was buying and allocating all imported lead. Seeking dollars, foreign producers increased their exports to the United States in 1947 when they could sell freely.

Throughout the year, demand for lead remained at unprecedented levels. Except for two months in the late summer, it exceeded supply. To meet requirements as best they could, producers drew on stocks of both refined lead and ore, and the government allocated practically all the lead remaining in its stockpile, which amounted to 45,500 tons Jan. 1, 1947.

During most of the year manufacturers added to their inventories of pig lead, although many started to draw on them toward the year end.

Table I shows the supplies of lead available for consumption in 1947 as compared with 1946.

The difference between available supplies and consumption is largely accounted for by the fact that consumers drew on their inventories of pig lead in 1946 to make up the deficit, whereas in 1947 they added slightly to inventories.

Despite the increased supply, all demands were not met. The demand for lead for batteries was amazing. For instance, 21,850,000 automobile replacement batteries were shipped in the first eleven months of 1947, compared with 16,309,000 in the same period of 1946. More than 2,800,000 were shipped in October and almost a like number in November, over twice that for the same months a year earlier.

The cable, paint, tetraethyl lead and many other industries could have used more lead than they obtained. The high price and sometimes limited supplies naturally tended to stimulate substitution but, with one major exception, these do not yet appear to be too important. The exception is foil. Before the war foil took 4 or 5%

Table I. United States Lead Supplies

	1946†	1947 (est.)
From: Domestic Ore	332,876	401,000
Foreign Ore	54,848	55,000
Scrap	392,787	450,000
Imports of Refined Lead	112,240	150,000
Reduction in: O.M.R. Stocks	23,207	44,000
Smelters Ore Stock	—22,374*	32,000
Producers Stocks of Pig Lead	— 5,283*	25,000
Total	888,301	1,157,000
Consumption (See Table II)	925,000	1,140,800

*Increase.
†Figures from American Bureau of Metal Statistics and U. S. Bureau of Mines.

Table II. Lead Consumption

	1946*	1947 (est.)
White lead	48,000	56,000
Red lead and litharge†	61,000	72,000
Storage batteries	260,000	360,000
Cable covering	111,000	155,000
Building‡	78,000	65,000
Tetraethyl	48,000	63,000
Automobiles	1,000	1,000
Ammunition	30,000	40,000
Terne plate	3,100	4,200
Foil	4,000	3,600
Bearing metal	41,000	42,000
Solder	53,000	56,000
Typemetal	33,000	26,000
Calking	39,000	50,000
Other uses	114,900	147,000
	925,000	1,140,800

*Figures from American Bureau of Metal Statistics.

†Exclusive of oxides for storage batteries.

‡Chiefly pipe, sheet and extrusions. Includes lead used in chemical construction.

of total lead consumed. During the war, the use of lead foil was prohibited for most packaging. The market has not been regained since the restrictions were removed because aluminum was plentiful and cheap. Table II shows lead consumption by usage in 1947 compared with 1946.

The high price has stimulated exploration for new deposits and the reopening and development of old ones. In Morocco, in Tanganyika and in Southwest Africa there are projects which may yield appreciable new production in the not too distant future.

All over the United States a search for more lead is in progress. Already there have been interesting new deep-level developments in Idaho and production is improving. Much of this work is still progressing. Indications are that there is still lead to be discovered in the United States.

Lead is thus ending the year with its price the highest in history, but perhaps not too high in relation to other commodities, which are still advancing, and to purchasing power. The year closed with supplies inadequate to meet demand, though a few months before it seemed that there would be more than enough lead to go around. During most of 1948 the consumption of lead is likely to remain on a high level. Production from domestic mines should improve gradually. Production from scrap, however, will probably not reach 1947's unprecedented high. There is little doubt that fairly heavy imports will be needed to make both ends meet.

The new year, however, offers several uncertainties which are difficult to estimate. What will be the impact of the Marshall plan on lead? It will probably have some effect on the amount of foreign lead available for export to the United States. Yet it is at least doubtful if the effect will be too great, because whatever aid is given to Europe will probably not permit purchases in excess of 1947, thus leaving as much or more foreign lead available to the United States.

Another question is what will our own Government's stockpiling policy be in 1948? During the year, to avoid disturbing the lead market, the government asked for offers of lead for the permanent military stockpile only once. This was in the late summer when demand had temporarily subsided. The amount purchased is understood to be small, probably only a few thousand tons, in comparison both with total lead consumption and the stockpile objectives. If, however, the policy should be changed and an effort be made to build up the stockpile more rapidly, it cannot but further increase the difficulty of supplying all demands.

At any rate, looking into 1948 with all its uncertainties, it appears that the man who owns a lead mine is still a lucky person.

Tin

Rising production and higher price are features of year in industry. Permanent basis sought for Texas City smelter

J. C. JOHNSON

Assistant Director
Division of Raw Materials
Atomic Energy Commission
Washington, D. C.

SATISFACTORY PROGRESS was made in 1947 toward restoring world tin production. This cheerful note is justified more by the higher production rate attained near the year end and by the improved prospects for 1948, than by the tonnage produced in 1947. Mine output totalled only 116,000 long tons, 30,000 tons less than the estimate made at the London tin conference in October, 1946, but, by the end of 1947, it was at the rate of more than 140,000 tons a year. The forecast of 167,000 tons for 1948, although 40,000 tons below the London estimate, is about 20,000 tons in excess of 1947 consumption, which was limited by controls and international allocation. Furthermore, the present forecast for 1948 seems conservative and a larger production would not be surprising. All estimates, however, must be qualified by reference to the potential danger from major political and economic disturbances.

Strikes in Bolivia and at the Billiton mines in the Indies contributed to the smallness of the output in 1947. The major error in the earlier forecasts, however, was in underestimating the time that would be required to restore production in the Far East. Material and food shortages, labor and political unrest, and financial problems all handicapped the rehabilitation

Table I. Estimated World Mine Production of Tin

(Long Tons Tin Content)

Countries	1947	1948
Malaya	27,000	48,000
Netherlands East Indies	16,000	37,000
Burma	750	1,500
Siam	1,500	3,000
China	4,000	6,000
Nigeria	9,500	9,500
Congo	14,000	15,000
Bolivia	34,000	38,000
All others	9,000	9,000
Totals	115,750	167,000

and operating programs last year.

In spite of failure to meet the optimistic forecast for 1947, mines of Malaya and the Netherlands East Indies, for the first time since 1941, supplied the world with a large part of its tin. Malayan output in 1947 was about 27,000 long tons (tin content) and that of the N.E.I. 16,000 long tons. Production in the first half was disappointing but by the end of 1947 Malayan mines were producing at the rate of over 40,000 tons annually and the Dutch mines at the rate of 24,000 tons. Eight large tin dredges, two of which were built in the United States, reached the East Indies in the second half of 1947 and either were operating or ready for operation by the end of December.

Before Japanese occupation, these two important tin mining areas furnished more than half of the world's annual tin supply. Under Japanese control, production dropped sharply and practically ceased in 1945. Although production in 1947 was nearly three times that of 1946, it still was only 50% of the 1935-1939 average and less than 40% of the rate expected to be reached in the next two or three years.

Exports of tin concentrates from Bolivia decreased for the second consecutive year. Because of increased costs and labor difficulties, 1947 production was only about 34,000 tons (tin content), as compared with 37,691 tons in 1946 and 42,483 tons in 1945. Conditions improved toward the end of the year and 1948 production promises to be 38,000 to 40,000 tons. The Patino mines suffered to a greater extent than those of the non-Patino producers who sell to the Reconstruction Finance Corporation. Deliveries to the RFC were approximately 18,000 tons of fine tin, about 1,000 tons less than in 1946.

Belgian Congo produced nearly the same tonnage in 1947 as in 1946, but Nigerian production was off about 2,000 tons. Although no important change is expected in 1948, African tin production is likely to show an upward trend because of additional reserves developed in the Belgian Congo.

Reports from China indicated a production of 4,000 to 5,000 tons in 1947. Little progress was made in Siam and Burma, with few of the large mines producing. These three countries, which together produced 34,000 tons in 1939, will probably have an output considerably less than 10,000 tons in 1948.

Although mine production may increase 50,000 tons, the supply of tin available for consumption in 1948 will not show a similar increase. In 1947, new production was augmented by accumulated stocks from Japanese occupied areas. The United States obtained about 16,000 long tons of metal from these sources and small quantities were shipped elsewhere. Except for 3,000 to 4,000 tons of tin metal remaining in Siam, and some small lots in various parts of the Orient, these stocks have been exhausted.

Table I gives the estimated mine production for 1947 and 1948.

For the first time since 1942, tin metal imports constituted a large part of the United States supply. In the first eleven months of 1947, the RFC purchased 39,220 long tons of foreign-produced tin metal, including 9,815 tons of Japanese tin which the U. S. Commercial Co. brought to this country in 1946 for sorting and for distribution pursuant to allocations of the Combined Tin Committee.

In addition to the Japanese tin, the RFC purchased tin metal from Malaya (16,750 long tons), Belgium and the Belgian Congo (4,550 long tons), Siam (5,000 long tons) and China (2,105 long tons). Also, 1,000 tons of Japanese-produced Banka tin was purchased from the Dutch.

The figure for total purchases includes 5,000 tons of Japanese and 2,000 tons of Siamese tin which had been allocated by the Combined Tin Committee in 1946. It also includes approximately 6,000 tons which did not arrive from the Far East until January, 1948, and was not reflected in the RFC year-end stock position.

The Government-owned tin smelter at Texas City, Texas, produced approximately 33,000 long tons of tin bullion in 1947. For processing at this plant the RFC purchased tin concentrates from Bolivia, Netherlands East Indies, Siam and Belgian Congo. Deliveries under 1947 contracts are expected to total about 29,500 long tons (tin content).

Table II shows the changes in the RFC tin metal and concentrate positions from Jan. 1 to Dec. 1, 1947. For eleven months ended Nov. 30, these figures show a reduction

Table II. Reconstruction Finance Corporation's Tin Position Stocks, Receipts, Sales in 1947 to Nov. 30

(Long Tons Tin Content)

Metal		
Stocks Jan. 1, 1947		22,662*
Imported Jan. 1 to Nov. 30, 1947		28,865†
Texas City smelter production		30,301
Total available		81,828
Sales Jan. 1 to Nov. 30, 1947:		
Longhorn tin	35,333	
Foreign tin	25,953	61,286
Stocks Dec. 1, 1947		20,542
Concentrates		
Stocks Jan. 1, 1947		30,722‡
Receipts Jan. 1 to Nov. 30, 1947		27,085
Total available		57,807
Smelted Jan. 1 to Nov. 30, 1947		29,918
Stocks Dec. 1, 1947		27,889‡
Metal and Concentrates		
Stocks Jan. 1, 1947		53,384
Stocks, Dec. 1, 1947		48,431
Deduction in stocks Jan. 1 to Dec. 1, 1947		4,953

*Includes 4,309 tons Japanese tin purchased by RFC in 1947

†Includes 5,406 tons of Japanese tin received in the United States in 1946.

‡Includes material in process, in transit, and stored abroad.

of approximately 5,000 long tons in RFC tin stocks—both metal and concentrates. It should be noted that metal stocks and imports cover only metal which arrived in this country, whereas concentrate stocks include materials in transit and stored abroad.

The Texas City Smelter

During 1947, the Texas City smelter produced approximately 33,000 long tons of tin metal as compared with 43,460 long tons in 1946. The drop resulted from the treatment of a larger quantity of impure ores and the depletion of concentrate stocks which had been accumulated before the smelter was started. Production in 1947 also was adversely affected by strikes at plants supplying the smelter with hydrochloric acid and by the Texas City disaster. The smelter itself was not harmed by the explosion, but its acid barges were badly damaged, and deliveries of concentrates and materials were interrupted. Also, many smelter employees living in the city suffered loss or injury.

Texas City has been receiving from 18,000 to 20,000 tons (tin content) of concentrates from Bolivia but the recent Bolivian-Argentine trade agreement threatens to divert 8,000 tons to Argentina, leaving only about 10,000 tons to be covered by a 1948 tin contract. The RFC now has a contract with the Dutch for nearly 35% of the 1948 Netherlands East Indies production, which should provide about 13,000 tons (tin content). An additional 3,000 to 5,000 tons may be obtained from other sources. On the basis of the present outlook, the smelter's tin metal production for 1948 is forecast at 25,000 to 30,000 tons.

Public Law 125, 80th Congress, enacted in June, 1947, authorized the RFC to buy, sell and transport tin metal and tin ores and concentrates; and to improve, develop, maintain and operate, by lease or otherwise, the Government-owned tin smelter at Texas City, Texas, until June 30, 1949, or until such earlier time as Congress shall provide. Congress is expected to hold hearings early in 1948 to determine the advisability of establishing a domestic tin smelting industry on a permanent basis.

Under existing legislation, the RFC probably will limit its purchases of tin concentrates to 1948 mine production so that deliveries can be completed before June 30, 1949. Unless legislation is passed in 1948 to establish a commercial tin smelting industry, or to extend the period of government operation, concentrates now going to Texas City may be diverted to foreign smelters.

In December, the RFC authorized the construction of a waste-acid plant to dispose of the waste liquor which results from the treatment of Bolivian ores. Approximately 100,000,000 gal. of this corrosive material is now stored in ponds at the smelter. This material constitutes a hazard and expense.

The domestic price of Grade A tin was advanced from 70c. to 80c. per pound, effective April 1, 1947. In the latter part of March, the RFC and the Bolivian producers reached an agreement on a contract for 1947 production. This provided for a base price of 76c. per pound f.o.b. South American ports, an increase of 9c. over the 1946 contract. Other tin producers throughout the world raised prices accordingly. The 80c. price permitted the RFC to import and sell Straits tin to domestic consumers without loss.

In December, 1947, the British Ministry of Supply took the initiative in raising the tin price without waiting for the conclusion of a new RFC-Bolivian contract. The Malayan selling price was raised £78 per long ton, equivalent to approximately 14c. per pound. Since the bulk of its tin metal purchases will be from Malaya, the RFC raised its selling price for Grade A tin to 94c. per lb., New York basis. At the time of writing, the RFC still was negotiating with the Bolivians for a 1948 contract.

Tin continued to be subject to international allocation and domestic control. In the closing days of the 80th Congress, the domestic tin-control program was extended to March 1, 1948, and a further extension probably will be authorized.

Light Metals

Light metals resist inflationary increases, gain competitive advantage as result

Aluminum

R. J. LUND and
C. M. CRAIGHEAD
Battelle Memorial Institute

WHILE PRICES for most raw materials and products were raised during 1947, aluminum and magnesium held to the same levels as those which prevailed under wartime price controls. This factor is expected to promote the use of aluminum in an expanded list of products, especially in the building field.

OUTPUT OF PRIMARY ALUMINUM in 1947 was the third largest in history. The total for the year will probably amount to about 575,000 short tons—a level exceeded only by the peak war output in 1943 and 1944, which amounted to about 920,000 and 776,000 tons, respectively. Secondary output is estimated to be close to 200,000 short tons—a sizeable reduction from the 278,000 tons of secondary output in 1946.

Marketwise the year opened fairly strong, but slackened demands coupled with other factors resulted in heavy total industry stock increases at the same time that stocks of Office of Metals Reserve metal were being drawn on to the extent of 20,000 tons in the first three months. Sizeable exports to South America, Asia, and Europe eased the picture somewhat in late spring, but stocks continued to increase until at the end of July they stood at 78,000 tons. Sale of Government metal stopped early in April. Later demand picked up substantially until ingot capacity was pushed to the limit at the year's end in attempting to meet demands. Contributing to a lower production level in the last half of the year was the shutdown of Reynolds Metals Company's Longview plant—closed in June to permit modernization.

Power shortages continued to dog the industry, especially since mid-

E & M J Me

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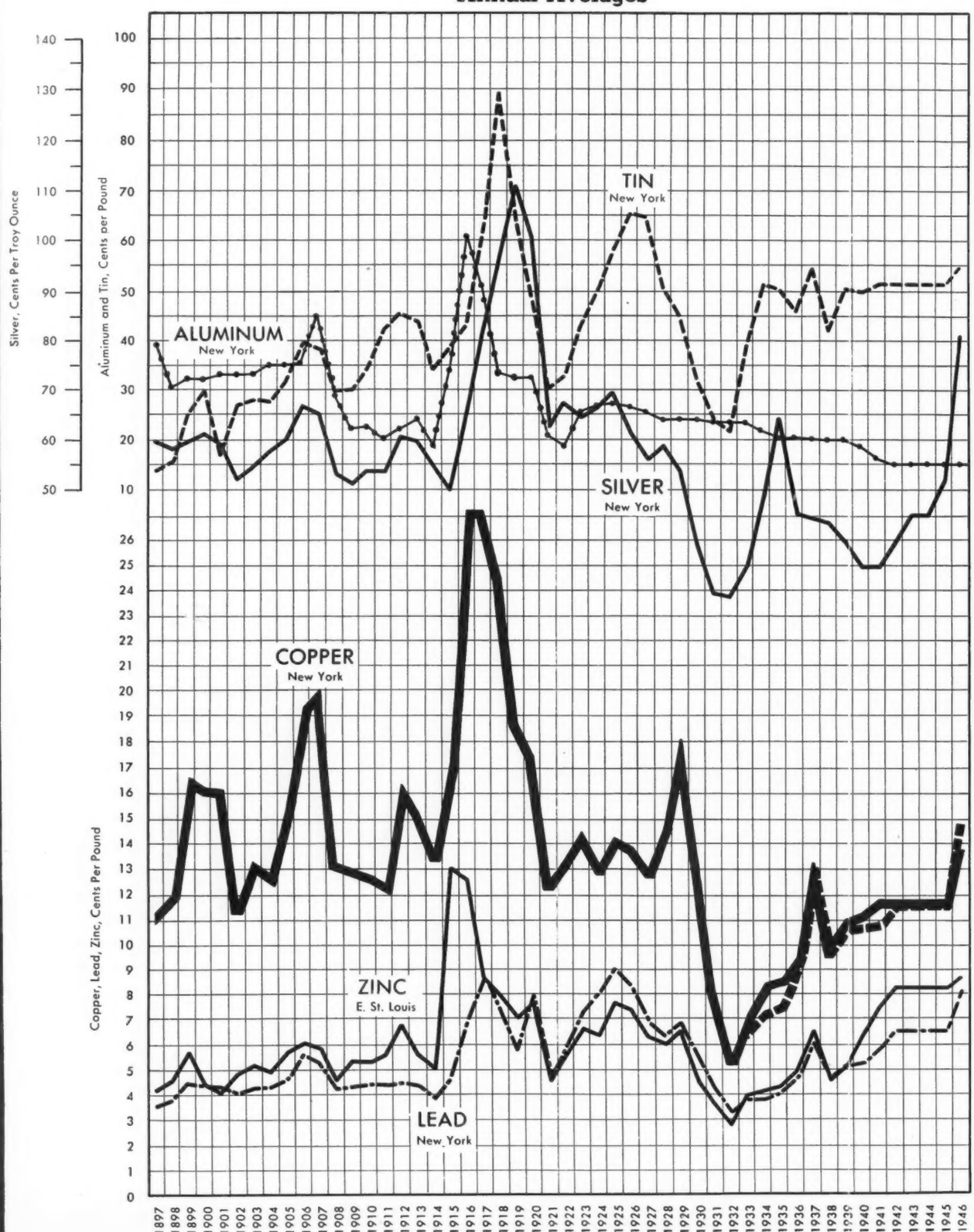
Annual Averages



Metal Prices

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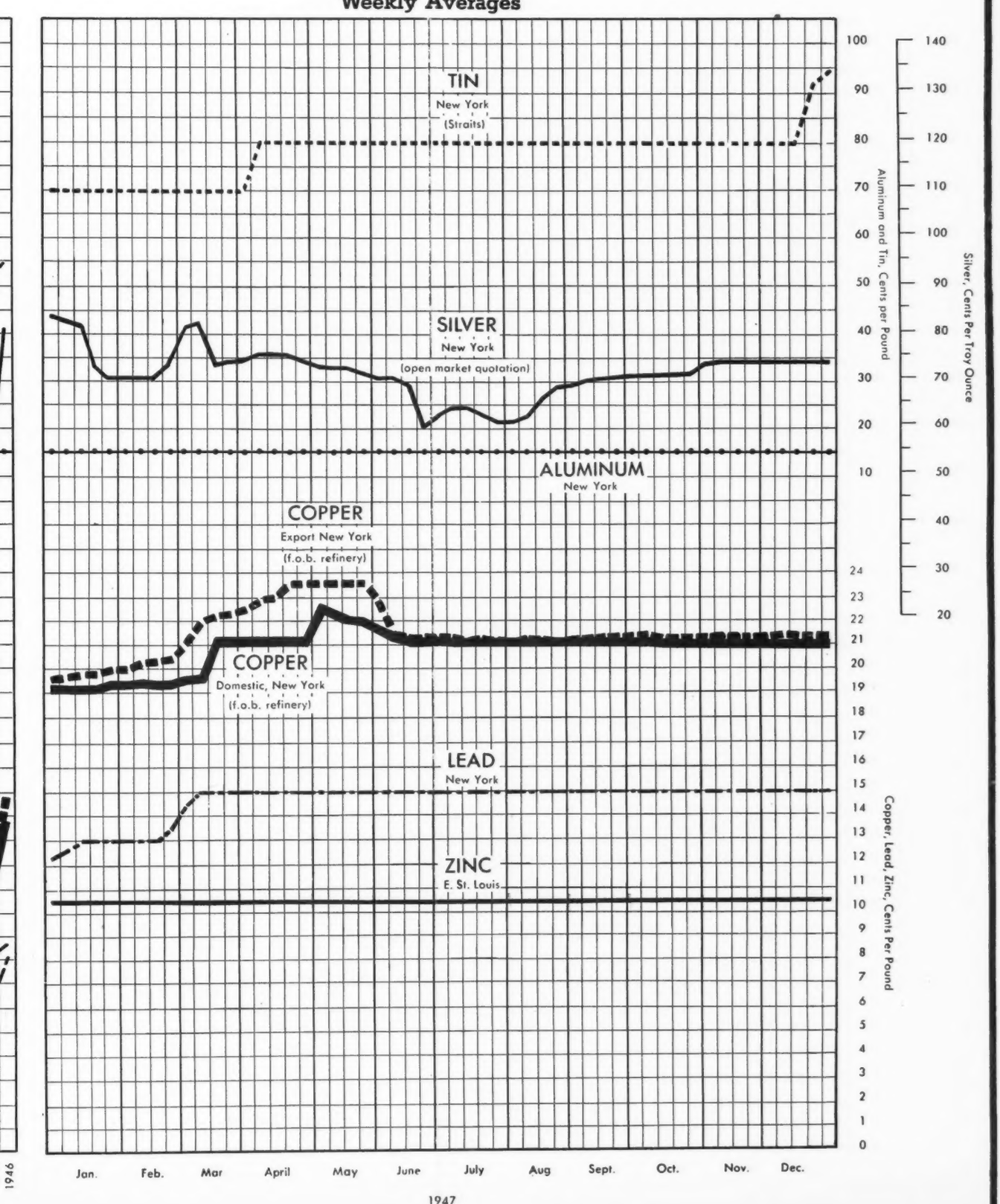
Weekly Averages
TIN
New York
(Straits)
SILVER
New York
(open market quotation)
ALUMINUM
New York
COPPER
Export New York
(f.o.b. refinery)
COPPER
Domestic, New York
(f.o.b. refinery)
LEAD
New York
ZINC
E. St. Louis
Aluminum and Tin, Cents per Pound
Silver, Cents Per Troy Ounce
Copper, Lead, Zinc, Cents Per Pound
100 90 80 70 60 50 40 30 20 10
140 130 120 110 100 90 80 70 60 50 40 30 20
24 23 22 21 20 19 18 17 16 15 14 13 12 11 10 9 8 7 6 5 4 3 2 1 0
Jan. Feb. Mar April May June July Aug Sept. Oct. Nov. Dec.
1947

Feb

E & M J Annual Average Metal Prices — 1897 to 1947

Year	Copper (a) Electrolytic Refinery	Lead Common, New York	Zinc, Prime Western (b) E. St. Louis	Tin, (c) New York	Silver, (e) New York
1897.....	11.29	3.580	4.120	13.67	59.790
1898.....	12.03	3.780	4.570	15.70	58.260
1899.....	16.67	4.470	5.750	25.12	59.580
1900.....	16.19	4.370	4.390	29.90	61.330
1901.....	16.11	4.330	4.070	16.74	58.950
1902.....	11.626	4.069	4.840	26.79	52.160
1903.....	13.235	4.237	5.191	28.09	53.570
1904.....	12.823	4.309	4.931	27.99	57.221
1905.....	15.590	4.707	5.730	31.358	60.352
1906.....	19.278	5.657	6.048	39.819	66.791
1907.....	20.004	5.325	5.812	38.166	65.237
1908.....	13.208	4.200	4.578	29.465	52.864
1909.....	12.982	4.273	5.352	29.725	51.502
1910.....	12.738	4.446	5.370	34.123	53.486
1911.....	12.376	4.420	5.608	42.281	53.340
1912.....	16.341	4.471	6.799	46.096	60.835
1913.....	15.269	4.370	5.504	44.252	59.791
1914.....	13.602	3.862	5.061	34.301(d)	54.811
1915.....	17.275	4.673	13.054	38.590	49.684
1916.....	27.202	6.858	12.634	43.480	65.661
1917.....	27.180	8.787	8.813	61.802	81.417
1918.....	24.628	7.413	7.890	88.750	96.772
1919.....	18.691	5.759	6.988	63.328	111.122
1920.....	17.456	7.957	7.671	48.273	100.900
1921.....	12.502	4.545	4.655	29.916	62.654
1922.....	13.382	5.734	5.716	32.554	67.528
1923.....	14.421	7.267	6.607	42.664	64.873
1924.....	13.024	8.097	6.344	50.176	66.781
1925.....	14.042	9.020	7.622	57.893	69.065
1926.....	13.795	8.417	7.337	65.285	62.107
1927.....	12.920	6.755	6.242	64.353	56.370
1928.....	14.570	6.305	6.027	50.427	58.176
1929.....	18.107	6.833	6.512	45.155	52.993
1930.....	12.982	5.517	4.556	31.694	38.154
1931.....	8.116	4.243	3.640	24.467	28.700
1932.....	5.555	3.180	2.876	22.017	27.892
1933.....	7.025	3.869	4.029	39.110	34.727
1934.....	8.428	3.860	4.158	52.191	47.973
1935.....	8.649	4.065	4.328	50.420	64.273
1936.....	9.474	4.710	4.901	46.441	45.087
1937.....	13.167	6.009	6.519	54.337	44.883
1938.....	10.000	4.739	4.610	42.301	43.225
1939.....	10.965	5.053	5.110	50.323	39.082
1940.....	11.296	5.179	6.335	49.827	34.773
1941.....	11.797	5.793	7.474	52.018	34.783
1942.....	11.775	6.481	8.250	52.000	38.333
1943.....	11.775	6.500	8.250	52.000	44.750
1944.....	11.775	6.500	8.250	52.000	44.750
1945.....	11.775	6.500	8.250	52.000	51.928
1946.....	13.820	8.109	8.726	54.544	80.151
1947.....	20.958	14.673	10.500	77.949	71.820

(a) Lake copper 1897-98; domestic market since 1932. (b) New York zinc 1898-1902. (c) 99 percent tin 1897 to 1920, inclusive; Straits quality thereafter. (d) Average for eleven months. (e) New York Official. All quotations in cents per pound, except for silver, which are in cents per troy ounce.

E & M J Weekly Average Metal Prices — 1947

		Copper — Domestic Refinery	Copper — Export Refinery	Lead New York, Common	Zinc E. St. Louis, Prime Western	Tin New York, "Straits"	Silver New York Official
Jan.	1...	19.275	19.625	12.550	10.500	70.000	83.750
	8...	19.225	19.779	12.700	10.500	70.000	82.650
	15...	19.225	19.871	13.000	10.500	70.000	81.500
	22...	19.225	19.971	13.000	10.500	70.000	73.400
	29...	19.363	20.050	13.000	10.500	70.000	70.750
Feb.	5...	19.342	20.038	13.000	10.500	70.000	70.750
	12...	19.375	20.383	13.000	10.500	70.000	70.750
	19...	19.350	20.446	13.000	10.500	70.000	70.750
	26...	19.355	20.529	13.400	10.500	70.000	73.350
Mar.	5...	19.679	21.217	14.479	10.500	70.000	81.450
	12...	20.779	22.079	15.000	10.500	70.000	82.250
	19...	21.225	22.333	15.000	10.500	70.000	73.500
	26...	21.225	22.438	15.000	10.500	70.000	74.675
April	2...	21.225	22.613	15.000	10.500	70.000	74.950
	9...	21.225	23.021	15.000	10.500	80.000	75.950
	16...	21.225	23.133	15.000	10.500	80.000	76.000
	23...	21.225	23.642	15.000	10.500	80.000	75.700
	30...	21.225	23.675	15.000	10.500	80.000	74.925
May	7...	21.715	23.679	15.000	10.500	80.000	73.350
	14...	22.513	23.675	15.000	10.500	80.000	72.750
	21...	22.138	23.675	15.000	10.500	80.000	72.750
	28...	22.104	23.675	15.000	10.500	80.000	71.550
June	4...	21.706	22.913	15.000	10.500	80.000	70.750
	11...	21.465	21.583	15.000	10.500	80.000	70.750
	18...	21.225	21.425	15.000	10.500	80.000	69.600
	25...	21.230	21.425	15.000	10.500	80.000	60.750
July	2...	21.230	21.425	15.000	10.500	80.000	62.750
	9...	21.225	21.425	15.000	10.500	80.000	64.750
	16...	21.225	21.233	15.000	10.500	80.000	64.750
	23...	21.225	21.396	15.000	10.500	80.000	63.350
	30...	21.225	21.371	15.000	10.500	80.000	61.750
Aug.	6...	21.225	21.200	15.000	10.500	80.000	61.750
	13...	21.225	21.396	15.000	10.500	80.000	62.750
	20...	21.225	21.383	15.000	10.500	80.000	66.550
	27...	21.225	21.371	15.000	10.500	80.000	69.250
Sept.	3...	21.225	21.320	15.000	10.500	80.000	69.375
	10...	21.225	21.346	15.000	10.500	80.000	70.250
	17...	21.225	21.392	15.000	10.500	80.000	70.500
	24...	21.225	21.400	15.000	10.500	80.000	70.975
Oct.	1...	21.225	21.408	15.000	10.500	80.000	71.375
	8...	21.225	21.413	15.000	10.500	80.000	71.375
	15...	21.213	21.396	15.000	10.500	80.000	71.375
	22...	21.200	21.333	15.000	10.500	80.000	71.375
	29...	21.200	21.396	15.000	10.500	80.000	71.475
Nov.	5...	21.200	21.425	15.000	10.500	80.000	74.250
	12...	21.200	21.425	15.000	10.500	80.000	74.625
	19...	21.200	21.488	15.000	10.500	80.000	74.625
	26...	21.200	21.483	15.000	10.500	80.000	74.625
Dec.	3...	21.200	21.492	15.000	10.500	80.000	74.625
	10...	21.200	21.529	15.000	10.500	80.000	74.625
	17...	21.200	21.483	15.000	10.500	80.000	74.625
	24...	21.200	21.467	15.000	10.500	91.667	74.625
	31...	21.200	21.460	15.000	10.500	94.000	74.625

Comparison of Aluminum and Magnesium With Steel and Other Metals in Respect to Price

	Specific Gravity	Weight (pounds) per Cubic Foot	Price per Pound (Cents as of Dec. 15, 1947)	Price per Cubic Foot (Dollars)
Aluminum	2.7	169	15	25.00
Magnesium	1.8	112	20.5	23.00
Pig iron	7.7	480	1.6	7.70
Steel	7.9	493	2.0	9.90
Copper	8.9	556	21.5	120.00
Lead	11.3	706	15.0	106.00
Zinc	7.1	443	10.5	46.50
Brass	8.5	531	18.0	95.60
Nickel	8.9	556	35.0	195.00
Tin	7.3	456	80.0*	365.00

*Late in December tin was raised to 94c. per pound.

1947. In the Pacific Northwest the Longview plant will be unable to resume operations until about June, 1948, being dependent on the installation of the eighth generator at Coulee Dam. Installation of the seventh generator at Coulee permitted the reopening of the Tacoma plant of Permanente Metals Corporation on October 31, but one pot line at the Mead reduction works of Permanente at Spokane remains inactive due to shortage of power. In the East a drought in the TVA area resulted in power shortages which necessitated the closing down of two pot lines at Reynolds' Listerhill plant in mid-summer.

Earlier in 1947 shortages of caustic soda also curtailed aluminum output. To prevent a repetition, Permanente Metals Corporation constructed a caustic plant of their own at Owens Lake, Calif.

State of surplus Government alumina and aluminum plant disposals at the end of 1947 remained substantially as reported in February by War Assets Administration. The disposal program requires that the plant at Massena, N.Y., now shut down, be offered on lease to Alcoa, subject to approval by the Attorney General, upon terms that offer no advantage over competitors. Disposal is contingent on the availability of a low-cost power source. Lack of cheap power is also the main factor in the Government's failure to sell or lease the reduction plants at Queens, N. Y., Burlington, N. J., Los Angeles, Calif., and Riverside, Calif. These plants are in various stages of cannibalization.

Moderate increase in domestic production of bauxite reflected the improved aluminum picture—output for nine months having been 917,000 long tons compared with 800,000 tons during the similar period in 1946. Imports soared to 1,436,000 long tons during the first nine months compared with 615,000 during the same period of 1946. Surinam supplied most of the imports. For the first time since 1941 bauxite was received from the Netherlands Indies, more than 50,000 tons having come in during the nine-month period. Two of the primary aluminum producers imported most of their bauxite, while the third relied solely on domestic ores.

Alcoa continued its exploration for ferruginous bauxite in northwestern Oregon. Experimental studies were made at Washington State College on methods for aluminum recovery from the extensive high-alumina clays of the Castle Rock district of Washington, and the U.S. Bureau of Mines announced results of tests on the diaspore clay deposits of central Pennsylvania.

Plans for the improvement and expansion of bauxite transfer facilities on the island of Trinidad were announced late in 1947 by Alcoa Steamship Co. New unloading, storing, and loading facilities, planned for completion in 1949, will expedite the transfer of bauxite from shallow-draught shuttle vessels, which bring it from the mines in Surinam, to large ocean-going vessels for transportation largely to the United States and Canada.

Scrap from wrecked aircraft continued to supply a substantial part of the total amount of scrap remelted in 1947. Secondary metal producers are using it to the extent of about 50% of the total obsolete scrap remelted by them or about 20 to 25% of the total (obsolete plus plant) scrap consumed. Primary producers also use substantial quantities, a total of 50,000 short tons having been consumed by them in 1946.

Fabricating facilities were reported to be adequate to meet most demands. However, one company reported that rolling capacity was inadequate, and another that indicated demands for die castings and for certain classes of both sheet and foil were ahead of scheduled production.

Alcoa's postwar construction and modernization program was virtually complete by the end of the year. The revamped extrusion plant at Cressona, Pa., started production in March; the new plant to produce caps and seals at Richmond, Ind., began operations in April; both the foundry at Bridgeport, Conn., and the foil mill at Alcoa, Tenn., started production in October; and both the new sheet and plate mill at Davenport, Iowa, and the new die casting plant at Hillside, Ill., were scheduled to start in Jan., 1948.

A further step in the complete integration of Kaiser's aluminum operations was announced in December. Permanente was the successful bidder for the first German reparations plant allocated to the United States—the Aluminumwerke Tscheulin plant located at Tennigen, Baden, Germany, one of the three largest German aluminum foil plants. It will be dismantled, shipped to the United States and reassembled probably in the State of Washington. Production is expected by mid-1948.

Aluminum Price Holds

The rather unique behavior of aluminum in 1947 in the price field is illustrated in the *E. & M. J.* chart, page 83, in which it is shown in comparison with other tonnage metals. Comparing prices as of Dec. 15, 1947, with the averages for 1939, both aluminum and magnesium showed a reduction of 25%, while steel (open hearth billets) increased by 32%, copper by 92%, zinc by 105%, and lead by 197%. This has brought the cost of aluminum on an equivalent volume basis far below copper, lead, and zinc, and much nearer to steel, as shown in the accompanying table.

The building trade now constitutes the largest single user of aluminum. One primary producer

estimates that 40% of its metal sales goes into this use; another reports that only 19% is so used, but it is probable that a substantial part of the 24% shown by them as sold "to fabricators for further processing" also goes into building construction eventually. Special aluminum sheet has been announced for roofing, siding, flashing, and duct work, as well as industrial buildings and portable sheds, at a price competitive with galvanized steel. According to one producer, this material is offered in gages up to and including 0.051 in. thick, and will withstand bending through 180 deg. around a radius of one-half its own thickness, making it suitable for lock seams.

Use Expands in 1947

Prior to the war the use of aluminum in windows for residences was considered experimental, but an estimate for 1947 places fabrication well above 2,000,000 units. Likewise, the use of aluminum for screens, awnings, garage doors, venetian blinds, and spandrels has increased.

In transportation, aluminum is being used increasingly in truck and trailer bodies, and in truck and bus wheels. Aluminum automotive tubing for oil, gasoline, vacuum, and hydraulic lines is a 1947 development. Automobile manufacturers have been turning to aluminum to replace scarce steel to hold their production at high levels. Ford engineers estimate they can produce 100,000 more cars per year by replacing 120 pounds of steel on a Ford car with aluminum. In all, 43 parts are being studied to determine the possibilities of substitution. Kaiser-Frazer plans to use aluminum instead of steel in gasoline tanks.

The largest single use of aluminum in the automotive industry is the aluminum piston and a new piston alloy, similar to A-132, but with improved casting characteristics and soundness, is expected to expand this use. The development of a stronger aluminum-bearing alloy (XB750—6.5% Sn, 2.5% Si, 1.0% Cu, 0.5% Ni, balance Al) has broadened the market for aluminum bearings.

The use of insulated aluminum wire and conductors was approved by the Underwriters Laboratories, Inc., in Sept., 1946, and this application has opened up a potentially large field for aluminum building wire.

Aluminum foil for packaging food products, particularly in the packaging of frozen foods, has increased during 1947. Other applications of interest are aluminum pipe for overhead irrigation and aluminum barbed wire.

Effective Jan. 1, 1948, the new U. S. import duty on aluminum in pigs and ingot forms will be 2c. per pound instead of 3c.; that on aluminum sheet, rod, and extrusions will be 3c. per pound instead of 6c.; and that on bauxite will be 50c. per ton instead of $1.00. This reduction may result in a further cut in aluminum prices in the United States, because the capacity of the Canadian industry is far ahead of their own requirements and is geared largely to the export market. Also, it is generally believed that cost of power at the Canadian plants is appreciably below that available in the United States. Canadian output of ingot in the first half of 1947 was 127,000 metric tons compared with 77,000 metric tons in the first half of 1946. Plans were announced in the summer by Aluminum, Ltd., for expenditures of $30,000,000 for plant expansion over a four-year period. Involved are the erection or expansion of fabricating facilities by subsidiary companies at Arvida, Kingston, and Shawinigan Falls, Canada, as well as in the United Kingdom, Mexico, South Africa, Switzerland, and Brazil.

Magnesium

FROM A FAIRLY HEALTHY START in 1947 the magnesium industry suffered a relapse until signs of recovery were evidenced in the late summer. Even so, Dow Chemical Co. in November estimated output of primary ingot for the full year at 11,000 short tons, compared with about 5,000 tons in 1946. Total production continues to come from Dow's Freeport, Texas, plant, which has a capacity of about 25,000 short tons annually.

Status of Government magnesium plants remained virtually unchanged throughout the year.

Overhanging the market as a serious threat is a stock of surplus incendiary bomb bodies amounting to about 30,000 tons. It is understood that these could be used satisfactorily in making aluminum alloys, but sale for this purpose has not been approved. Apparently this metal will be disposed of eventually in an orderly manner with a minimum impact on the market.

Pricewise, virgin magnesium ingot held at 20.5c. per pound. After Dec. 1, however, the metal has been priced f.o.b. Freeport, Texas.

Since freight had been allowed on previous sales it is expected that the cost to customers will be thus increased by an average of about one cent per pound.

Although the price of ingot on a volume basis is even less than aluminum, as shown in the accompanying table, the price of wrought products is comparatively much higher. Eastwood[1] pointed out that the price of fabricating magnesium (disregarding comparative metal cost) is from six to ten times that required to fabricate the same volume of steel, and attributed this large difference to the relatively small scale of operation with concomitant lack of good engineering and mass production methods.

Recently, press equipment of 18,000 tons capacity has become available for the fabrication of large-size magnesium forgings. Study of the preparation of large-size forging stock has indicated that such stock can be produced without appreciable loss in properties as a result of size.

Research and development on grain refinement, initiated during the war, has received some commercial application. In England, solid organic chloride for grain refinement of magnesium-base alloys, rather than superheating, is being employed commercially. This practice decreases metal loss and fuel consumption and increases the life of the pot. Some simultaneous degassing is obtained. Another similar technique uses chlorine and carbon tetrachloride vapor for simultaneous gas removal and grain refinement.

The high-strength alloy (ZK60 [6% Zn], 0.7% Zr, balance Mg) is of considerable interest because of the high compressive yield strength developed by this composition.

The magnesium casting industry at present occupies a favorable competitive position in respect to other materials as a result of the low price of secondary magnesium. Secondary metal is available at about three cents per pound and is being used directly, without preliminary melting and treatment, in magnesium casting alloys. Eastwood[1] indicates that in some cases magnesium castings can be produced at prices competitive with cast iron.

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[1]Eastwood, L. W., Economic Aspects in the Use of Aluminum and Magnesium, Materials & Methods, June, 1947, pp. 63-68.

Minor Metals

Prices higher for most of these metals, likewise mine production and prices. Consumption up also, with some exceptions

CHARLES WHITE MERRILL
Chief
Metal Economics Division
U. S. Bureau of Mines

THE ADVANCED STATE of industrial reconversion from war to peace and the high level of industrial activity were reflected in the minor metals, where the consumption rates for 1947, so far as determined, were higher than in 1946 and where other indices, like mine production, imports and price, were up for most of the metals. Consumption data for bismuth, arsenic, and cadmium were incomplete, but recessions were not indicated. For the other metals except those of the platinum group, consumption was definitely up.

In mine production, too, higher levels were the rule, although the output of platinum and of mercury was off and the records for cadmium and beryllium showed little change. Cobalt ore production in the United States remained negligible.

Except for bismuth, beryllium, mercury, and some of the platinum-group metals, imports were generally up. To a large extent, the metals entered the United States in a form requiring treatment as in ores, concentrates or constituents of unrefined base metals. Exports were a minor factor in most metals of this group, although substantial quantities left the country in manufactures.

Information on stocks is not as complete as for some other items, but the phenomenal consumption rates seem to have been supported to some extent by drafts on commercial stocks. Stocks of cadmium, most of the platinum-group metals, and beryl concentrates dropped during 1947, and cobalt and mercury stocks were nearly unchanged. Ilmenite stocks rose.

Most of the minor metals shared in the inflationary price movement of 1947, although the price of mercury declined, arsenic was unchanged and ilmenite price was nearly unchanged. The price record of the platinum-group metals was mixed and speculation played a role in the movements. All the metals had been freed of Government controls except with respect to exports before 1947, with the exception of antimony, the distribution of which continued to be allocated.

Antimony

RICHARD H. MOTE
Mineral Economist
U. S. Bureau of Mines

THE DOMESTIC ANTIMONY industry in 1947 was characterized by substantial gains in production of primary and secondary metal and a record high peacetime market price. Domestic mine production of recoverable antimony was about 5,000 short tons, nearly double the 1946 output of 2,505 tons and closely approaching the record of 5,556 tons produced in 1943. As in previous years, the Yellow Pine mine of the Bradley Mining Co., in Idaho, was the principal producer. Recovery of antimony in antimonial lead and other alloys from scrap at secondary smelters and by remelters in 1947 totaled 21,600 tons, an increase of 13% over the 19,115 tons similarly recovered in 1946. Plates, grids, and sludge from discarded batteries continued to be the main source of secondary antimony.

Industrial consumption of primary antimony, based on data for nine months of 1947, probably will exceed the 17,515 tons contained in finished products made in 1946. Addition of secondary antimony will add substantially to the total consumption which may exceed 40,000 tons. Little change is noted in the use pattern which prevailed in 1946. Government stocks of antimony contained in ore and metal increased from 4,632 tons on Jan. 1, 1947 to 6,831 tons on Nov. 30. These stocks consisted of 6,571 tons of metal and 260 tons of ore at the end of November compared with 2,929 tons and 1,703 tons, respectively, on Jan. 1, 1947.

During 1947, the market price for domestic brands of metallic antimony reached a record high level for peacetime, when the price was advanced from 28.25c. per pound, Laredo, Tex., to 33c. per pound March 15. Prior to 1947, the top price in peacetime had been 25c. in 1926. The record high for antimony occurred during 1916, when the demand for metal for use in shrapnel boosted the market price to 45c. per pound.

Imports of antimony contained in ore were about 8,000 short tons, 35% greater than in 1946. Imports of metal increased almost 70% to 4,400 tons. Mexico supplied over 80% of the antimony contained in ore; approximately 13% came from Bolivia. Virtually all the metal imported was of Chinese origin

Antimony remained under Government allocation control during all of 1947 through provisions of General Preference Order M-112.

Arsenic

RICHARD H. MOTE
Mineral Economist
U. S. Bureau of Mines

DOMESTIC PRODUCTION of crude and refined arsenic in 1947 will be about double the quantity, 10,211 short tons, produced in 1946. Arsenic output is largely a by-product of the smelting and refining of complex copper and lead ores, and the quantity produced is directly related to the output of these metals. Refined-lead production from domestic smelters increased 17% in 1947 and smelter output of copper, which usually accounts for more than 85% of the arsenic produced, gained 43%.

Despite increasing use of organic insecticides, such as DDT and benzine hexachloride, the general demand for insecticides and fungicides containing arsenic continued strong, owing to the intensified programs for production of domestic food and fiber.

Total white arsenic imports for

1947 probably will not vary greatly from the 13,822 tons imported in 1946. Imports for the first 10 months of 1947 totaled 11,854 short tons, almost 78% of it from Mexico. U.S.S.R. and Sweden supplied 11% and 7%, respectively, and the remaining 4% came from Peru, Poland, Portugal, France, Canada and Bolivia.

The quoted price for white arsenic remained stabilized at 6c. per pound, delivered in carlots, throughout 1947.

Beryllium

ALLAN F. MATTHEWS
Mineral Economist
U. S. Bureau of Mines

SALES OF beryllium-copper and beryllium metal were notably greater in 1947 than in 1946, and concern deepened as to the availability of ore supplies to maintain the industry. Apparent consumption of beryl in the United States was about 4,000 short tons in 1947, compared with 1,577 tons in 1946 (excluding consideration of changes in consumers' stocks).

Consumers depended for ore primarily on the Office of Metals Reserve, which in the first 10 months of 1947 shipped to industry 2,891 tons of the 4,118 tons of beryl it possessed on Jan. 1. Domestic mine production is not expected to have exceeded the low level of 1946, when 95 tons was shipped from South Dakota and 5 tons from New Hampshire.

Imports of beryl in the first 10 months of 1947 were 712 short tons, 666 from Brazil and 46 from Australia, according to the U. S. Department of Commerce. Entries in 1946 totaled 1,098 tons, comprising 906 from Brazil, 119 from India, 53 from Argentina and 20 from Australia.

Beneficiation studies of beryllium ores of New England (Report of Investigations 4040) and Western States (Report of Investigations 4071) were published by the Bureau of Mines. Smelting of beryllium in 1947 was confined to four plants, three in the United States and one in France. The German beryllium industry was originally scheduled for dismantling, but occupation authorities in mid-1947 decided to make the plant unavailable for reparations, pending further review. The Italian beryllium plant has now been converted to a cast-iron foundry.

The price of domestic beryl, f.o.b. mines, advanced from $10-$12 per short-ton unit of BeO in January, 1947, and $12-$14 in February, to $14-$16 in late March through November and $16-$18 in December. This climb nearly closed the usual price differential between domestic and foreign beryl. Imported beryl, f.o.b. Atlantic port, was quoted at $14-$16 per unit in January, $17 in early February, and $18 after mid-February. Beryllium-copper master alloy, 4% Be, was sold at $14.75 per pound of contained beryllium (plus copper at market) during the first half of 1947, $17 from July 7 to Oct. 19, and $20.50 thereafter.

Bismuth

RICHARD H. MOTE
Mineral Economist
U. S. Bureau of Mines

INASMUCH AS metallic bismuth is produced from lead and copper smelting residues, production in 1947 is expected to increase sharply over 1946 because of the marked gain in copper and lead output from domestic smelters. Pharmaceutical uses—principally anti-acid or stomach remedies and cosmetic powders—continued to dominate the consumption pattern.

Based on data for the first 10 months of 1947, total imports of refined metallic bismuth for the year will be about 30% less than in 1946. Of the 260,381 lbs. imported through October, 260,365 lbs. was from Peru and 16 from Canada. Except for 30,030 lbs. from Canada in 1946, all entries of refined metallic bismuth in 1941-46 were from Peru. Almost the entire output of bismuth in Mexico is imported as bismuth-lead bars for refining in the United States. Exports of bismuth metal and alloys are expected to increase about 50% over 1946. Data for the first 10 months of 1947 indicate that the bulk of the exports went to the United Kingdom.

The market price for metallic bismuth remained relatively stable during 1947 and, for most of the year, was at the highest level since 1928. At the beginning of the year the New York price in ton lots was $1.80 a pound. On Feb. 20 it advanced to $2 a pound and remained unchanged thereafter.

Bismuth-metal inventories of the Office of Metals Reserve, which totaled 586,546 lbs. on Jan. 1, 1947, were completely disposed of during the year.

Cobalt

HUBERT W. DAVIS
Mineral Economist
U. S. Bureau of Mines

THE PEACETIME DEMAND for cobalt continued to expand in 1947, chiefly because of greater usage in cast cobalt-chromium-tungsten-type alloys and ground-coat frit for porcelain enamel. Consequently, imports, production, and sales of cobalt metal were 330, 50 and 51% more, respectively, in the first nine months of 1947 than in the corresponding period of 1946, and production of oxide was 33% greater. Imports of oxide, however, were 23% smaller; sales were about the same in each period.

Consumption of cobalt (exclusive of salts and driers) by industrial consumers was 2,442,000 lbs. in the corresponding period of 1946. The largest single use was for permanent-magnet alloys, which accounted for 26% of the total quantity consumed in the first nine months. Usage for this purpose, however, during this period was substantially less than in 1946. The anticipated peacetime demand for cobalt for cast cobalt-chromium-tungsten-type alloys materialized in 1947; as a consequence, the quantity of cobalt employed for this purpose was substantially greater than in 1946. Continuing its upward trend, usage of cobalt in ground-coat frit for porcelain enamel in 1947 was also much greater than in 1946.

Consumption of cobalt contained in alloy and ore by refiners and processors was 1,947,000 lbs. during the first nine months of 1947, compared with 1,333,000 lbs. in the corresponding period of 1946. Consumption of other cobalt materials by refiners and processors was 704,000 lbs. in the first nine months, compared with 561,000 lbs. in the corresponding period of 1946.

Bethlehem Steel Co., which re-

covers cobalt as a byproduct at its Cornwall iron-ore mine in Pennsylvania, was the only producer of commercial cobalt ore in 1947; output in the first nine months of 1947 was about double that in the corresponding period of 1946. The St. Louis Smelting & Refining Co. shipped some raw iron concentrates averaging about 2% cobalt from its property near Fredericktown, Mo.

Imports of cobalt into the United States during the first nine months of 1947 were substantially more than in the corresponding period of 1946. The 1947 imports comprised 1,289 short tons of alloy containing 1,104,974 lbs. of cobalt from Belgian Congo; 376 tons of Canadian ore containing 77,721 lbs. of cobalt; 4,420,250 lbs. (gross weight) of rondelles, fines and granules, chiefly from Belgium and Belgian Congo; 476,350 lbs. of oxide containing 338,200 lbs. of cobalt from Belgium, and 396 lbs. (gross weight) of salts and compounds from the United Kingdom.

Exports of cobalt are small and during the first nine months comprised 326 lbs. of metal and alloy. Some cobalt oxide and salts are also exported, but the quantities are not known.

Effective July 1, 1947, the price of cobalt metal (97-99%, in kegs of 550 lbs.) was advanced from $1.50 to $1.65 per pound delivered east of Chicago. For quantities under 100 lbs. the price was raised from $1.57 to $1.72.

Cadmium

RICHARD H. MOTE
Mineral Economist
U. S. Bureau of Mines

EXPANSION OF SLAB-ZINC output at domestic smelters was not accompanied by a similar gain in the production of byproduct cadmium metal; as a result, domestic cadmium output in 1947 probably will be approximately the same as in 1946, the smallest since 1940. Data on the production of primary cadmium compounds are incomplete, but the total for 1947 is expected to equal roughly the 1946 output.

Although complete statistics on cadmium consumption are unavailable, preliminary data indicate that the use pattern remained about as in 1945 and 1946, with plating and bearing alloys accounting for most of the consumption.

The New York price was $1.50 a pound for commercial sticks and $1.55 for patented shapes until Feb. 17, when it advanced to $1.75 and $1.80, respectively, at which levels it remained the balance of the year.

Imports of cadmium-bearing flue dust were approximately 50% above the 1946 rate, and receipts of metal about 35% larger. Mexico was the only country from which flue dust was imported in 1947. Canada supplied over 70% of the metal imported and virtually all the rest came from Peru.

Government stocks of cadmium metal Nov. 30 were 458,415 lbs., 21% less than the 580,960 lbs. available Jan. 1. 1947.

Mercury

HELENA M. MEYER
Mineral Economist
U. S. Bureau of Mines

ALTHOUGH CONSUMPTION of mercury probably was 5% to 10% greater in 1947 than in 1946, and about a quarter above levels that prevailed in the 10 years prior to World War II, the price continued its downtrend, with only one slight interruption, since January, 1946. Except for metal imported from Japan by the United States Commercial Co. in the first quarter, entries in 1947 were far below prewar rates and, even including this metal, were much less than the prewar average. Domestic production dropped about 9% below 1946. The reduced production and the relatively small imports together were scarcely adequate to take care of industrial needs for mercury in 1947, an unexpected situation. Throughout the year, however, foreign stocks—fed by production in excess of requirements outside the United States—presented a growing threat to the domestic market.

California dominated the United States output again in 1947, with almost 75% of the total of 23,100 flasks; Nevada ranked second, with over 15%; Oregon and Idaho ranked third and fourth, contributing the rest. Outstanding mercury-producing properties were the New Idria, San Benito County, Calif., ranking first in the country, with Mount Jackson, Sonoma County, second. Others (not necessarily in order of output) were the Reed, Yolo County, Calif., and Bonanza, Douglas County, Ore. At the end of the year, Cordero had nosed into second place as a mercury producer. The six properties listed contributed 92% of the total United States output. Of these mines, only the Reed was closed in the last quarter.

General imports of mercury totaled 8,247 flasks in the first 10 months of 1947. Of the total, 3,403 flasks were entered in March, and 3,107 flasks of this quantity were credited to Japan. This metal was for the account of the United States Commercial Co. and was officially reported as 2,900 flasks, of which 1,800 were Italian and 1,100 Japanese metal. The mercury was for sale, and all of it was reported to have been disposed of by the end of October. Of the balance received in the first 10 months, 2,161 flasks came from Spain, 1,443 from Mexico, 1,416 from Italy, and 120 from Chile.

Exports totaled 570 flasks in the first 10 months of 1947 and reexports 2,929 flasks.

The over-all world surplus of mercury caused a weakening in prices, both in the United States and abroad. Here, the price fell continuously, with the exception of a slight upturn in March, 1946, from $105 a flask in January, 1946, to less than $80 a flask in December, 1947. The decline was orderly, however, and the average 1947 price was only 15% lower than in 1946. Mercurio Europeo dropped the cartel price for mercury $14.50 a flask in May, 1947, to the basis of $65 a flask at Spanish and Italian ports. In August, the price was further reduced to $60 a flask. London prices were similarly reduced.

Dry Cell Important Factor

Mercury consumption turned up slightly in 1947, with greater gains in prospect for 1948. The quality and performance of the new dry cell are reported to have made good progress in 1947. This use is believed to hold the answer as to whether or not mercury consumption will experience an early increase. Total consumption may rise several thousand flasks in 1948, if prospects for the new cell are realized. Two factors on which this accomplishment depends are low prices and assured supplies. The Belfast, Ireland, plant is an important supplier of batteries to the British Government. Research in connection with new mercury boiler installations may bring about

greater use of the metal, and low prices are a stimulant in this direction. No other known uses hold equal promise for large-scale gains in consumption.

Platinum Metals

HUBERT W. DAVIS
Mineral Economist
U. S. Bureau of Mines

DEMAND MUCH IN EXCESS of the new supply of refined metal made available, fluctuation in price, and some speculation were features of the platinum industry in 1947. Noteworthy also was the much smaller demand for palladium. The retail price of platinum and ruthenium ranged from $56 to $69 an ounce in 1947 and iridium from $75 to $110. Quotations on palladium, osmium and rhodium, however, were static at $24, $100 and $125 an ounce respectively throughout the entire year.

Refining of platinum in the United States during the first nine months of 1947 was at a rate 22% lower than in the corresponding period of 1946 and far below the domestic demand, which was moderately greater than in 1946. The deficiency was met by imports of metal, chiefly from Canada, U.S.S.R. and United Kingdom, and by withdrawals from inventories of refiners and dealers. The jewelry trade was by far the largest outlet for platinum in 1947, but demand was 34% less than in 1946. Sales of platinum to the electrical industry and the dental profession were also less. The smaller sales to the jewelry, electrical and dental trades were more than offset by greatly increased demand by the chemical industry and the Bureau of Federal Supply; however, total sales to consumers (172,000 oz.) in the first nine months of 1947 were 11% smaller than in the corresponding period of 1946. Imports of refined platinum during the first nine months of 1947 were 88,217 oz. and exports 12,927 oz.

Refining of palladium during the first nine months of 1947 proceeded at a slightly higher rate than in 1946, but was only one-fourth of sales (115,000 oz.). These, however, were about one-third smaller than during the corresponding period of 1946. The smaller recovery by domestic refiners was supplemented by imports of 101,063 oz. of refined palladium during the first nine months, chiefly from Canada and U.S.S.R. The electrical industry was again the largest user of palladium and was the only industry to register a gain over 1946, as sales to the chemical, dental and jewelry industries declined markedly.

Refining, consumption and imports of the other platinum metals —iridium, osmium, rhodium and ruthenium — were comparatively small. Less iridium, osmium and rhodium but more ruthenium were refined in the first nine months than in the corresponding period of 1946. Less iridium and ruthenium but more osmium and rhodium were imported. Sales of iridium, osmium and ruthenium were smaller, but those of rhodium were larger than in 1946.

Titanium

HELENA M. MEYER
Mineral Economist
U. S. Bureau of Mines

DEMAND FOR ILMENITE remained at unprecedented peacetime levels in 1947, and consumption pushed into new high territory. The record capacity performance of 1946 was surpassed, thanks to pigment plant-capacity gains in 1947. Capacity pigment production fell far short of requirements, however, and the use of competitive pigments was momentarily stimulated. Plant expansion, in progress at the end of 1947 and already long delayed, was expected to be completed, possibly in the first quarter of 1948. Inability to obtain equipment was the principal deterrent to meeting construction schedules. Demand for rutile appears to have dropped considerably in 1947.

Production and shipments of ilmenite exceeded 300,000 short tons each and were close to the highest rates ever achieved, falling only slightly below the peaks for 1945. The gains of 7% in production and 8% in shipments in 1947, as compared with 1946, were shared in by all producers except one which had slightly smaller quantities. The National Lead Co.'s mine at Tahawus, N. Y., continued as the world's leading ilmenite producer. Others were the Rutile Mining Co. of Florida, near Jacksonville, Fla.; Yadkin Valley Ilmenite Co., Finley, N. C.; and Calco Chemical Division, American Cyanamid Co., Piney River, and American Rutile Corp., Roseland, both in Virginia. Rutile production was well maintained in 1947, but shipments dropped. Rutile was produced by the Rutile Mining Co. of Florida and the American Rutile Corp., already mentioned.

Ilmenite Imports Increase

There were sharp gains in imports of ilmenite in 1947, the total of 276,000 short tons for the first 10 months of the year exceeding the annual total for 1946 by 14%. Little doubt exists that entries in all of 1947 will exceed the previous all-time peak of 287,000 tons in 1939. India supplied 241,000 tons in the first 10 months of 1947, Norway 21,000 tons, and Australia and Canada the remainder in virtually equal quantities. Rutile imports for 10 months of 1947 likewise exceeded the 5,900 tons received in all of 1946, but for the year probably fell far short of the record 1943 total. Almost all of the rutile that was brought into this country came from Australia.

Although data on ilmenite stocks are not available at this time, concentrates on hand undoubtedly rose 150,000 tons or more in 1947, so that year-end inventories could support consumption at the record 1947 rate for more than one year unassisted by new production or imports.

Prices for ilmenite changed little in 1947 following a $9 to $10 drop in 1946. They were $19 to $20 a long ton for ilmenite containing 57% to 60% TiO_2, f.o.b. Atlantic seaboard, according to grade and impurities, when the year ended as when it began, having declined to a low of $17 to $19 in midyear. Rutile prices continued to be quoted at 8c. to 10c. a pound, guaranteed minimum 94% concentrate. Quotations for both of these products during the year were reported to be nominal.

The Supreme Court, in a midyear decision, upheld the ruling of a lower court concerning monopolistic practices in the titanium pigments industry. The Office of International Trade removed export curbs on titanium dioxide and titanium-extended pigments.

Ferro-Alloy Metals

Tariff duties lowered on some ferro-alloys and ores. Consumption generally high.

CHARLES WHITE MERRILL

Chief, Metal Economics Division
U. S. Bureau of Mines

PRELIMINARY FIGURES for 1947 compared with those for 1946 show an increase in the domestic consumption of each of the ferro-alloying raw materials discussed below. Output of ferro-alloys themselves—ferromanganese, spiegeleisen, ferrochromium, molybdenum products, ferro-tungsten, ferro-vanadium—all were larger in 1947 than 1946. The aggregate output of all ferro-alloys exceeded that for 1946 by 22% in quantity and 24% in value. This upward movement paralleled the unprecedented peacetime iron and steel production in 1947. Alloy steel production, which is more of a guide to demand for these materials, shared in the general high rate of steel output.

Domestic mine production of most of the ferro-alloying raw materials in 1947 did not change appreciably. Output of molybdenite was higher, manganese ore was little changed, and chromite and nickel were insignificant, as in 1946.

Imports of chromite, tungsten, and vanadium rose, but those of manganese and nickel fell. Molybdenum imports are not important. Exports, except for molybdenum, were unimportant in both years—molybdenum exports were larger in 1947 than in 1946.

Stocks of most ferro-alloying raw materials rose during 1947, but stocks of vanadium ore and nickel fell. Probably the prospect of a lower duty after Jan. 1, 1948, was the principal motivation for reducing nickel stocks in the United States.

In general, ferro-alloying raw materials did not participate in the general inflationary movement of prices, the most noticeable exception being tungsten concentrates and ferrotungsten. Chromite, molybdenum and nickel resisted the upward trend, and manganese ore decreased in price during the year.

Nickel

HUBERT W. DAVIS
Mineral Economist
U. S. Bureau of Mines

CONSUMPTION OF NICKEL in the United States in 1947 undoubtedly will exceed that in 1946, but sales to the Government stockpile were less, and as a consequence total demand in the United States was probably only moderately greater. Imports of nickel into the United States were substantially less in 1947 than in 1946, indicating a substantial reduction in inventories of suppliers and consumers, possibly in anticipation of the lower rate of duty.

Output of nickel in Canada was 85,335 short tons during the first nine months of 1947 compared with 69,891 tons in the corresponding period of 1946. Exports of nickel from Canada during these periods were 89,746 and 83,637 tons, respectively.

Production of nickel oxide in Cuba was discontinued on March 31, 1947, and the United States Government-owned nickel mining and processing facilities were declared surplus and transferred to the War Assets Administration on July 11. Output of oxide was 2,893 short tons (2,200 tons nickel content) in 1947 compared with 16,040 tons (12,391 tons nickel content) in 1946. Exports of oxide from Cuba were 6,615 short tons (5,100 tons nickel content) in 1947 compared with 13,953 tons (10,742 tons nickel content) in 1946.

Imports into the United States from Canada during the first ten months of 1947 (figures for full year 1946 are shown in parentheses) comprised 98,613,457 (141,433,524) lb. of metallic nickel, 22,582,045 (38,092,080) lb. of matte, and 11,605,773 (1,352,021) lb. of oxide.

During the first ten months of 1947 (figures for full year 1946 are shown in parentheses) Cuba supplied 13,282,551 (27,689,919) lb. of oxide, Norway 2,498,311 (9,999) lb. of metallic nickel, the United Kingdom 283,602 (881,000) lb. of metallic nickel and 21,798 (none) lb. of oxide, and the U.S.S.R. 110,243 (none) lb. of metallic nickel.

Exports of nickel consist largely of products manufactured from imported raw materials. During the first ten months of 1947 (figures for full year 1946 are shown in parentheses) they comprised 15,032,373 (11,194,004) lb. of alloys and scrap; 2,465,237 (1,883,881) lb. of metallic nickel; 1,099,053 (817,003) lb. of nickel-chrome electric resistance wire; 2,640,152 (2,037,788) lb. of nickel silver; and 999 (21,083) lb. of ore, concentrates, and matte.

The rate of duty on refined nickel imported into the United States was reduced 1¼ c. a pound (a 50% reduction), effective Jan. 1, 1948. Accordingly, the International Nickel Co., Inc., has announced a corresponding reduction in price for refined nickel in the United States; the new price is 33¾ c. a pound.

Vanadium

HUBERT W. DAVIS
Mineral Economist
U. S. Bureau of Mines

OUTPUT AND CONSUMPTION of domestic vanadium ore turned upward in 1947, and during the first nine months more was produced and used than during the entire year 1946. Imports of vanadium ore and concentrates in 1947 were only moderately greater than in 1946.

Production and consumption of domestic vanadium ore were 1,729,000 and 1,671,000 lb. (contained vanadium) respectively, during the first nine months of 1947 compared with 1,272,148 and 1,495,839 lb., respectively, during the entire year 1946.

During the first nine months of 1947, ore and concentrates containing 630,390 lb. of vanadium were received from Peru, and vanadium-bearing flue dust containing 71,799 lb. of vanadium was imported from Curacao. Comparable figures for the entire year 1946 were 791,057 and 20,931 lb. respectively.

Complete data are not available on consumption of ferrovanadium and chemical compounds, but based on information furnished by identical companies it is apparent that usage was 29% greater during the first nine months of 1947 than during the corresponding period of 1946. Consumption of vanadium in steel, which accounted for about 96% of the reported total, was 30% greater, but usage for other purposes was up only 14%.

Since 1935 the price of vanadium ore has been quoted at 27½c. a pound of vanadium pentoxide. The price of ferrovanadium was advanced from $2.70-$2.90 to $2.90-$3.10 a pound of contained vanadium on Sept. 4.

Tungsten

HUBERT W. DAVIS
Mineral Economist
U. S. Bureau of Mines

LACK OF OFFERINGS of tungsten concentrates of suitable quality, greatly increased world demand, speculation, and much higher prices were features of the tungsten industry in 1947. To ease the shortage in the United States during the first half of 1947, some members of the tool-steel industry tried unsuccessfully to have tungsten released from the Government stockpile. Largely because of shortage of supplies, European competition for South American tungsten, and increased domestic demand, the price of tungsten concentrates in the United States had advanced to a peak of $33 a short-ton unit of WO_3 by mid-July. Following an improvement in supply and buyer resistance, the price dropped to $28 by the year end. Despite the much higher prices, output of concentrates at domestic mines in 1947 was less than 1946; however, production was much greater during the third quarter than during the first quarter of 1947.

Production of tungsten concentrates is expected to approximate 3,000 short tons, (60% WO_3 basis) in 1947, a 39% drop from 1946. The Nevada-Massachusetts Co. and the United States Vanadium Corporation (Riley mine), both Nevada operations, and the Tungsten Mining Corporation, a North Carolina operation, were the chief producers of tungsten concentrates in 1947.

General imports (receipts) of tungsten ores and concentrates into the United States were 7,151 short tons (60% WO_3 basis) during the first 10 months of 1947 (7,157 tons during the entire year 1946). These quantities represent the ores and concentrates received in the United States, irrespective of final disposition. Bolivia (1,093 tons), Brazil (1,092 tons), Spain (1,083 tons), Korea (1,002 tons), China (786 tons), Thailand (626 tons), and Belgian Congo (578 tons) supplied 88% of the 1947 total.

Imports of ores and concentrates for consumption in the United States were 4,877 short tons (60% WO_3 basis) during the first ten months of 1947 (7,218 tons during entire year 1946). These quantities represent ores and concentrates on which the duty has been paid and which have thereby entered into the domestic commerce of the United States. Brazil (869 tons), Bolivia (824 tons), Thailand (561 tons), Belgian Congo (522 tons) and China (457 tons) supplied 66% of the 1947 total.

During the first ten months of 1947, 837 tons (60% WO_3 basis) of ores and concentrates were withdrawn from warehouses for smelting, refining, and export (1,724 tons during entire year 1946), and 571 tons (gross weight) were reexported (1,517 tons during entire year 1946).

Consumption of tungsten concentrates during the first nine months of 1947 was at a rate about 40% greater than in the corresponding period of 1946. During the first nine months of 1947 total consumption was 6,134 short tons (60% WO_3 basis) compared with 4,354 tons in the corresponding period of 1946 and 6,800 tons during the entire year 1946.

Prices on tungsten concentrates fluctuated substantially during 1947. Quotations on Chinese ore ranged from $24 to $33 a short-ton unit of WO_3, duty paid, and domestic scheelite of good known analysis, in carlots, delivered, from $24 to $32 a unit. Prices on ores and concentrates from Bolivia, Brazil, and other countries fluctuated between $21 and $33 a unit, duty paid. Four price advances were made on ferrotungsten in 1947, and as a consequence the quotation on this product was raised from $1.90 to $2.50-$2.55 a pound of contained tungsten.

The rate of duty on tungsten ore and concentrates was lowered to 38c. per pound on the metallic tungsten contained therein, or $6.03 a short-ton unit of WO_3; this is a reduction of 24% in the former rate, which was 50c. a pound of contained tungsten or $7.93 a short-ton unit of WO_3. The effective date of the new rate of duty has not been determined, but is expected before June 30, 1948.

Chromite

NORWOOD B. MELCHER
Mineral Economist
U. S. Bureau of Mines

THE YEAR 1947 OPENED with chromite in short supply, as in 1946. Metallurgical-grade was especially short in the first quarter of 1947, inasmuch as receipts from the Soviet Union were very small. The total chromite available in the first quarter was 188,000 short tons, whereas consumption amounted to 218,000 tons. Deliveries improved during the second quarter of the year and were plentiful thereafter; and receipts of metallurgical ore from the U.S.S.R. exceeded 25,000 tons during each of the months from July through October, inclusive. During the second quarter consumption of all grades of chromite amounted to only 73% of the new supply, and this was improved further in the third quarter when receipts of foreign ore amounted to 350,000 tons compared with a consumption of 191,000 tons. At the close of the year supplies of all grades of chromite were adequate, although there were indications of a shortage of certain chromium chemicals. Domestic production of chromite for 1947 is estimated at 1,500 tons, all of which was produced from two mines in California.

Total consumption of chromite during 1947 was estimated at 800,000 short tons compared with 734,759 tons in 1946. Of the 1947 total, approximately 60% was used in the manufacture of chromium alloys and chemicals, 35% in refractories, and 5% for other purposes, mainly in repairing basic-furnace lin-

ings. Receipts of foreign ore are estimated at 1,100,000 short tons during the year compared with 757,391 tons during 1946. Of the total received during the first nine months, 24% originated in the Union of South Africa, 23% in U.S.S.R., 18% in the Republic of the Philippines, 16% in Cuba, and the balance (19%) in British West Africa, Canada, French Pacific Islands, India, Mozambique, Southern Rhodesia, Turkey, and Yugoslavia. Virtually all of the ore received from Cuba and the Republic of the Philippines was refractory grade. The metallurgical ore originated mainly in the U.S.S.R., Turkey and Southern Rhodesia, and most of the chemical ore came from the Union of South Africa.

At the close of the year, the price of chromite was quoted at $39.00 per long dry ton f.o.b. cars, Atlantic ports, for Indian and African chromite having a Cr_2O_3 content of 48% and a chromium iron ratio of 3:1. South African ore of 48% Cr_2O_3 content having no specific chromium: iron ratio was $28.50 per ton. The latter ore is mostly chemical grade. There is no import duty on chromite.

Manganese

NORWOOD B. MELCHER
Mineral Economist
U. S. Bureau of Mines

THE SUPPLY OF MANGANESE ORE was generally easy during 1947, although imports of foreign ore declined appreciably from the record year of 1946. Domestic production continued at a rate which was high for a peace-time year but was only slightly more than one-half that of the peak war-year 1944. Most of the domestic production came from the nodulizing plant of the Anaconda Copper Mining Co. at Anaconda, Mont., but a small output was reported from mines in Arizona, Arkansas, Nevada and New Mexico. Domestic output is estimated at 137,000 short tons during 1947, shipments were virtually the same and stocks of ore at mines at the end of the year were 2,000 tons. During 1946, output of domestic ore, as measured by shipments from mines, totaled 143,635 tons. Shipments of ore containing (natural) 5 to 35% manganese increased over 1946 and amounted to 1,215,000 short tons. Minnesota supplied nearly 88% of this total; New Mexico, 12%; and Montana, less than 0.5%. Nodules from Montana were shipped to Eastern furnaces for conversion into ferromanganese, but plans were being considered for construction of a plant at Anaconda to produce ferromanganese in electric furnaces.

Ferro Output Up

Ferromanganese production in 1947 was estimated at 580,000 short tons, an 18% increase over 1946 production. In the manufacture of manganese alloys, 1,250,000 tons of ore is estimated to have been used. In 1946 1,053,270 tons were used in the manufacture of ferromanganese, silicomanganese and manganese briquets. Including consumption for dry cells, chemicals and miscellaneous uses, a total of 1,136,687 tons was consumed in 1946. The total for 1947 will be substantially greater. Consumption in dry cells will approximate 50,000 short tons, chemicals will use about 20,000 tons, and other uses will require about 15,000 tons.

Imports of manganese ore containing 35% or more manganese are estimated at 1,500,000 tons during 1947 compared with 1,749,223 tons in 1946. The actual receipts for the first ten months of 1947 were 1,244,780 tons, of which 26% originated in India, 21% in U. S. S. R., 17% in the Union of South Africa, 13% in Gold Coast, and 11% in Brazil; the balance (12%) was received from British East Africa, Canada, Cuba, Chile, Mexico, Mozambique, and the Republic of the Philippines. Of the manganese ore received during the first ten months of 1947, 62,421 tons was battery-grade for use in making dry cells. This ore was received mainly from Gold Coast and U. S. S. R. Small quantities came from Chile, India and Mexico.

Prices of manganese ore decreased generally during 1947, but that of ferro increased early in September from $135.00 per gross ton to $150.00. Current (December 1947) quoted prices for manganese ore, in cents per long ton unit, delivered Eastern and Gulf ports, containing 48 to 50% manganese, range from 65 to 67c., whereas prices for ore of similar grade at the beginning of the year were 70 to 71c. per unit. The import duty on manganese ore containing 35% or more manganese continued at one-half cent per pound of contained manganese throughout 1947. This tariff was reduced to one-fourth cent per pound of manganese, to be effective Jan. 1, 1948.

Molybdenum

HUBERT W. DAVIS
Mineral Economist
U. S. Bureau of Mines

COLORADO WAS DISPLACED by Utah in the first nine months of 1947 as the premier molybdenum producing state. However, Colorado retained first place as a shipper of molybdenite concentrates. Production of molybdenite concentrates in Colorado in general is geared to demand, whereas that in Utah is recovered as a byproduct of copper operations.

Domestic production and shipments of molybdenite concentrates were 20,820,500 and 14,857,100 lb. (contained molybdenum) during the first nine months of 1947, compared with 11,997,200 and 10,406,400 lb., respectively, in the corresponding period of 1946 and with 18,218,000 and 16,304,000 lb., respectively, during the entire year 1946. Molybdenite concentrates were produced in Utah, Colorado, New Mexico, Arizona, and Nevada. Production of molybdenite concentrates was 40% greater than shipments during the first nine months of 1947; as a consequence, stocks held by producers increased to 21,071,500 lb. on Sept. 30.

Consumption of molybdenite concentrates was 14,333,500 lb. (contained molybdenum) during the first nine months of 1947 compared with 11,028,600 lb. in the corresponding period of 1946 and with 14,994,000 lb. in the entire year 1946. Stocks held by consumers declined to 2,797,100 lb. at the end of the nine-month period.

Exports of molybdenite concentrates were 2,050,215 lb. (contained molybdenum) during the first nine months of 1947 (564,924 lb. during entire year 1946). The United Kingdom (911,673 lb.), France (555,840 lb.), and Italy (392,378 lb.) were the chief customers.

No molybdenum concentrates were imported into the United States in the first nine months of 1947. Concentrates containing a minimum of 90% MoS_2 were quoted at 45c. a pound of MoS_2 throughout 1947.

Non-Metallics

Demand for industrial minerals is heavy —New uses developed for some products

G. RICHARDS GWINN
Mineral Economist
Bureau of Mines

WILLIAM H. WAGGAMAN
Senior Mineral Technologist
Bureau of Mines

THE CONSUMPTION of non-metallic minerals continued to increase in 1947, and with the pressing need for building materials, heavy chemicals, high grade refractories, metallurgical fluxes, and fertilizer materials, this trend promises to continue during 1948.

Abrasives

MILD ABRASIVES and polishing materials such as diatomite, whiting talc, and calcium phosphate were produced in adequate quantities to meet all requirements. Synthetic alumina abrasives produced from domestic sources were also plentiful, but domestic deposits of natural corundum that can be economically exploited are very limited, and hence the bulk of this mineral consumed in 1947 was imported. The Bureau of Mines is conducting investigations with a view to producing boron carbide and alloys having physical properties that will render them suitable for core drills as a partial substitute for industrial diamonds.

Industrial diamonds were in great demand by the manufacturers of drill bits, diamond dyes, and diamond set lathes for turning abrasive wheels. The trend in diamond drill bits in the past few years has been away from the drill with a few large diamonds to one containing many small diamonds embedded in metal. The positive identification of carbonados, the opaque gray or black, tough, compact variety of industrial diamond in Venezuela, has recently been announced.

Building Materials

Because of the possible economies in labor and other building costs, renewed interest is being evinced in light-weight aggregate for concrete and molded products. Such materials are being produced from blast furnace slag, waste slate, and clays with or without the addition of small percentages of reagents that cause the products to swell and assume a cellular structure when heated to a sintering temperature.

The production of expanded perlite, a relatively new light weight aggregate and insulating material, progressed from the pilot plant stage to commercial production. An attempt is being made to set up specifications and standards for this product. However, because perlite is a rock and not a single mineral, its composition may vary greatly from deposit to deposit and even within the same deposit. The largest volume of sales has been made of the perlite plaster hardwall aggregate, and aggregate for precast masonry building units. Fines which may make up from 10 to 30% of the expanded product are being used as filter aides, and thus are in direct competition with diatomite. A plant is under construction in Chicago to make perlite slabs for use as insulation in refrigerator railroad cars. It is believed that slabs will be more stable and prevent failure of the refrigeration near the roof which may occur when loose fill material is used. Perlite (in the form of fines) has also been suggested as a thickener for paints. Such fines have the same index of refraction as linseed oil and may be substituted for the more costly aluminum stearate.

Insulating Materials

ASBESTOS—Demand for asbestos continues above the supply. Canada and Africa are still the major producing countries for this material. Deposits of blue asbestos are being developed in Northwest Australia, which it is hoped will assure an adequate supply for that country. There is a shortage in the United States of all grades of fiber, particularly the short fiber. Fireproof fabrics of asbestos and glass for use in theatres, night clubs, trains, airplanes or other similar places of public assembly have recently been announced. The new product has high flexibility, good strength, and resistance to abrasion, and will be produced in a form suitable for dyeing and printing in a variety of colors and patterns. Other new or possible uses of this material are: asbestos board as a substitute for canvas on which paintings are executed, and a component of a plastic floor covering which contains asbestos, sawdust and a binder.

MICA—The output of punch and sheet mica has returned approximately to pre-war levels, and punch mica makes up about 90% of the material recovered. Because of relatively poor preparation of domestic mica it is utilized almost entirely in products requiring only low grade material. In contrast to the sheet mica, industry's demand for scrap which is utilized in the production of ground mica has been greater than the supply. This is attributed to the excessive demands of the construction industry for paint and roofing.

MINERAL WOOL—The mineral wool industry continued to expand during 1947, and new plants in Florence, Colorado, Buffalo, New York, and Kansas City, Kansas, got into production. Additional plants in Oregon, California, Washington, and Alabama were under construction. New equipment designs for insulating materials have been perfected to manufacture products that are both weatherproof and thermally efficient to meet requirements of the increased number of plants in which equipment is not actually housed. The demand for mineral wool blanket type insulation and pipecovering, particularly for underground, nested and bundled installations, has increased because of their lightweight, thermal efficiency and ease of installation. Lead slag containing 30 to 50% calcium oxide or combined calcium and magnesium oxide has been recommended as raw material for the production of mineral wool insulation because it produces a resilient fiber with good resistance to chemicals.

VERMICULITE—Large quantities of exfoliated vermiculite from domestic deposits were used by the construction industry in lightweight aggregate, and in plaster. Substantial quantities were also imported from South Africa by

East Coast producers. Structural concrete roof decks of a 5-to-1 mix (5 parts vermiculite concrete aggregate to 1 part Portland cement) have a "K" factor of .69 per inch thickness. It is said to be unaffected by moisture and can be installed as a monolithic covering in one operation, thus eliminating the problems of sawing, cutting and fitting required for the installation of slab type products. It is also reported that pre-fabricated houses of vermiculite concrete panels are under construction in Michigan. The panels, three inches thick, 16 in. wide and 6 to 8 ft. long are made by pouring a vermiculite concrete mix into a light steel reinforcing form. Loose fill vermiculite insulation is also recommended for filling the open spaces in cavity wall type construction.

New deposits of this material have been found in Fulton, Hall, Meriweather, Raburn, Jasper and Elberton Counties of Georgia.

Fertilizer Materials

PHOSPHATE ROCK—For the fifth successive year, the production of phosphate rock showed a substantial increase and most of the phosphate mining plants have expanded their facilities to take care of the growing demand.

Florida continued to produce the bulk of the phosphate rock consumed in 1947 with Tennessee a poor second and the Western states third. A small amount of apatite was marketed from Virginia, but no output was reported from South Carolina, Kentucky, or Arkansas.

The production of phosphate rock in Idaho, Montana, and Utah has shown a greater proportional expansion than that from any of the other phosphate areas, due partly to the exportation of a large tonnage to occupied countries, but chiefly to the increased use of phosphate fertilizer in the states west of the Mississippi River.

If these vast deposits are to be successfully developed on an extensive scale, it will be necessary to manufacture highly concentrated products that will withstand the high cost of transportation to established markets; therefore, great interest is being evinced in the furnace processes for manufacturing elemental phosphorus which can be shipped to fertilizer consuming centers and converted into phosphoric acid, and phosphate products. At least two companies are contemplating the construction of electric furnaces in the West and several are treating the rock with sulphuric acid to produce both ordinary and concentrated superphosphate.

The Department of Interior has been active in formulating a program for the development of the Western phosphates and in this connection has made a careful survey of existing data on the location of promising rock deposits, sources of power, fuel and manufacturing sites, transportation facilities and potential markets.

Although the bulk of the phosphate rock is used in the manufacture of fertilizer, the consumption of pure phosphoric acid and phosphate salts for food and chemical purposes continues to expand and certain new organic and inorganic phosphorus compounds are being marketed. In addition, so-called polyphosphates are finding increasing favor as detergents and water softeners.

POTASH—In 1947, the production of potash in the United States exceeded that of any previous year. Four major concerns not only supplied the domestic demand for potash salts, but produced an exportable surplus. The natural salt deposits in New Mexico continued to be the chief source of potash, but substantial tonnages were also obtained from the brines of Searles Lake, California, and the Salduro Marsh, Utah. Minor quantities of potash were recovered as by-products.

Diamond drilling by the Bureau of Mines of potash reserves in Eddy County, New Mexico, disclosed over 9 million tons of minable potash ore and milling tests showed the practicability of recovering the potash contained therein.

NITROGEN PRODUCTS — Although Chilean nitrate of soda and the ammonium sulphate recovered as a by-product in the coking of coal continue to supply a substantial tonnage of nitrogenous salts for fertilizer purposes, the bulk of the "fixed" nitrogen is now obtained from synthetic sources. The Government-owned nitrogen plants were closed at the end of hostilities, but nearly all of them have been reactivated and are being operated either by private industry or the Army.

Metallurgical and Heavy Chemical Minerals

FLUORSPAR—The total output of fluorspar in 1947 showed a substantial increase over the previous year and probably exceeded the production of 1945. The bulk of this mineral was consumed as a flux in the manufacture of steel, but elemental fluorine and hydrofluoric acid derived from fluorspar are playing an increasingly important role in the manufacture of numerous fluorine compounds of immense industrial importance. The glass, ceramic, enamel and other industries also used tonnages of fluorspar equal to or in excess of those consumed in 1946.

SALT AND SODA PRODUCTS—Salt continued in heavy demand. The output was approximately the same as in 1946, but fully 50% higher than in the year immediately preceding the war. Rock salt from the Louisiana mines is being shipped up the Mississippi by barge to Memphis, Tennessee, for use in the manufacture of chlorinated benzol products, which form the basis of D.D.T., dye stuff intermediates and many other produtcs. The deep salt beds recently discovered under the middle Ohio River Valley are continuing to draw industrial plants to this region. Industries which require large quantities of salt are those engaged in the manufacture of synthetic rubber, soap, high test gasoline, sulphur drugs, plastics, and dry cleaning fluids.

The shortage of soda ash in 1947 was world wide, and programs for the erection of new plants or expansion of existing facilities were either under way or in the planning stage in several countries. The demands by manufacturers of aluminum, glass for automobiles, window glass, and glass containers, textile and paper products were well above the capacity of the ten domestic producers in 1947. Permanente (the Kaiser Aluminum Company) completed a new soda ash plant at Owens Lake, and American Potash and Chemical Co. began an expansion program at their Searles Lake plant. These two plants are the only operations based on the recovery of soda ash by the natural soda ash process. Solvay Process Company and the Wyandotte Chemical Co. also began the erection of new plants. The completion of the plant at Owens Lake marks a step in Permanente's plans to establish a fully integrated aluminum industry. The entire output at Owens Lake will be utilized at the Baton Rouge, Louisiana, plant of Kaiser Aluminum in the manuafcture of alumina from bauxite.

SULPHUR — Production and shipments of sulphur in 1947

reached a record total as the demand for sulphuric acid by the fertilizer, steel and oil refining industries continued to mount. The output of native sulphur accounted for most of the gains as pyrite production increased only slightly. Expansion programs included new plants, mines, and increased operation efficiency of existing equipment.

Construction was started on a new plant at Moss Bluff, Texas, by the Texas Gulf Sulphur Co., and the Sheridan Construction Co. began open cut mining of a gypsum-sulphur deposit on the floor of an extinct geyser basin west of Cody, Wyoming.

Ceramics and Refractories

The advances made in the domestic ceramic industry are such that our white-ware, porcelain, glass, and enameled products rival or surpass those formerly imported. As for refractories that must meet specifications that are continually growing more exacting, the United States is well supplied with most of the necessary raw materials and is acquiring the knowledge and skill to fabricate them into superduty products.

FELDSPAR—This industry experienced another boom year as output topped the record set in 1946. Continued demands by the construction industry for glass and enamel products and the expanding pottery trade have kept the consumption of this mineral at near capacity levels. Several additional mills started operations in 1947.

Tests conducted by the Bureau of Mines on certain mica-feldspar deposits in Hudspeth County, Texas, indicated that a muscovite-mica concentrate for the roofing trade, a low-iron feldspar concentrate and a clean quartz tailing could be recovered.

CLAYS — The consumption of ceramic and refractory clays increased in 1946, and the indications are that the demand in 1947 was somewhat greater. During the war this country used domestic kaolin for white-ware, pottery and porcelain, and the knowledge gained was such that it appears doubtful if imports of this material will ever again reach pre-war figures.

GRAPHITE—Of all refractory materials graphite is the least reactive with molten slag and metals. Unfortunately, it is rapidly attacked at high temperatures by air and oxygen-yielding materials, hence can be used effectively only under conditions where oxidation can be controlled. Domestic graphite is not used to any great extent in the manufacture of crucibles.

Interest in the graphite industries in the United States in 1947 was concerned chiefly with the production and marketing of manufactured and collodial graphite. Domestic output of natural graphite remained at approximately the same level as in the previous year. Imports of crucible grade graphite from Madagascar were small because of an insurrection on the Island.

Demand for manufactured graphite for batteries and graphite carbon products was heavy. Colloidal graphite used by the ferrous and nonferrous metal industries in such operations as die casting, extrusion, wire drawing and similar operations contributes not only to rapid output of metal products but also reduces maintenance costs.

KYANITE AND SILLIMANITE —The domestic kyanite industry experienced another boom year as requirements for high temperature refractories continued strong. The sillimanite deposits in the Southeast States continue to show some promise, but only a few are of commercial size or quality. It is reported that several sparkplug manufacturers are interested in this material. A refractory produced from domestic flint clay, tabular alumina, and bonding clay that has the approximate properties of those made with Indian kyanite has been successfully marketed this year. Flint clay is first calcined to eliminate shrinkage, tabular alumina is added and the product is ground to specific grain size. A bonding clay is then added and the product is burned, producing a high temperature refractory. "Commercial Ores Incorporated" with offices in New York City and Clover, South Carolina, have started work on a plant to mine and mill the kyanite deposit on Henry Knob, S. C., and expect to be in production early in 1948.

Miscellaneous Minerals

BARITE—This mineral is one of a group in which tariff concessions were made by the United States. The effective date of the reductions is January 1, 1948. This means a reduction in tariff from $4.00 to $3.50 per ton for crude barite ore. Output in 1947 is expected to approximate the record attained in 1946. Plant expansions and technical improvements in plant equipment have been reported by several operators. One plant installed a revolving grizzly which has increased capacity 25%. The problem of separating high grade barite concentrates from extremely fine grain siliceous ores by froth flotation has been solved and it is now possible to recover barite from low or mixed ores ground through 325 mesh, and between 10 to 30% 7.5 microns.

LITHIUM MINERALS — The output of lithium minerals continued the upward trend started in 1946 as demands for di-lithium sodium phosphate and spodumene increased to meet increased peacetime requirements for many uses which were perfected during the recent war period. Experimental results have demonstrated that it is technically feasible to produce lithium metal by reacting a mixture of spodumene, lime and either ferrosilicon or aluminum in a vacuum furnace. It is believed that the cost of producing lithium metal by this method, sufficiently pure for present markets, will be below the costs of the electrolytic process. The following are some of the new or proposed uses for lithium compounds: fluorides of lithium for aluminum welding fluxes; waxes composed of lithium stearate and parafins, that may ultimately be used in the manufacture of cosmetics, crayons, polishing waxes, printing inks, and insulators for electrical equipment; lithium aluminum hydride used for the reduction of pharmaceuticals, perfumes, dyestuffs, intermediates, and as a source of hydrogen and a propelant.

QUARTZ CRYSTALS — Brazil remains virtually the world source of radio grade quartz. The bulk of the demand in 1947 has been for small size material yielding plates one-half square inch in size. The commercial production of ethylene diamine tartrate crystals for use as piezoelectric oscillator plates was started in 1947. These man-made crystals will be substituted for quartz plates in telephone lines and other places where the units are not subjected to severe temperature changes and rough handling. Quartz crystals oscillator plates are still essential for the more exacting uses and must still be stockplied for national defense.

LOADING IRON ORE into shuttle car in an eastern mine. Loader has been strengthened and improved in design for this heavy service. Car has been armor-plated.

Mining Practice Marked by

High costs and labor inadequacy still provide a spur to mechanize operations and to apply improved techniques and equipment in both underground and surface work

A. H. HUBBELL
Managing Editor

CHANGING MINE-OPERATING practice exhibits much of interest. The rather detailed account given[1] in these pages last spring, supplemented later by the pictorial presentation[2] of developments and trends prepared by *E. & M. J.'s* staff for the November issue, will serve as background for the additions made in the following paragraphs:

Of the underground operations, blast-hole drilling still holds the spotlight. Attention may well be focussed also on loading, haulage and transport, in all of which something has been achieved and more is promised. The labor situation continues to be a spur to progress, promoting mechanization. The latter is still hampered in many places by slow deliveries.

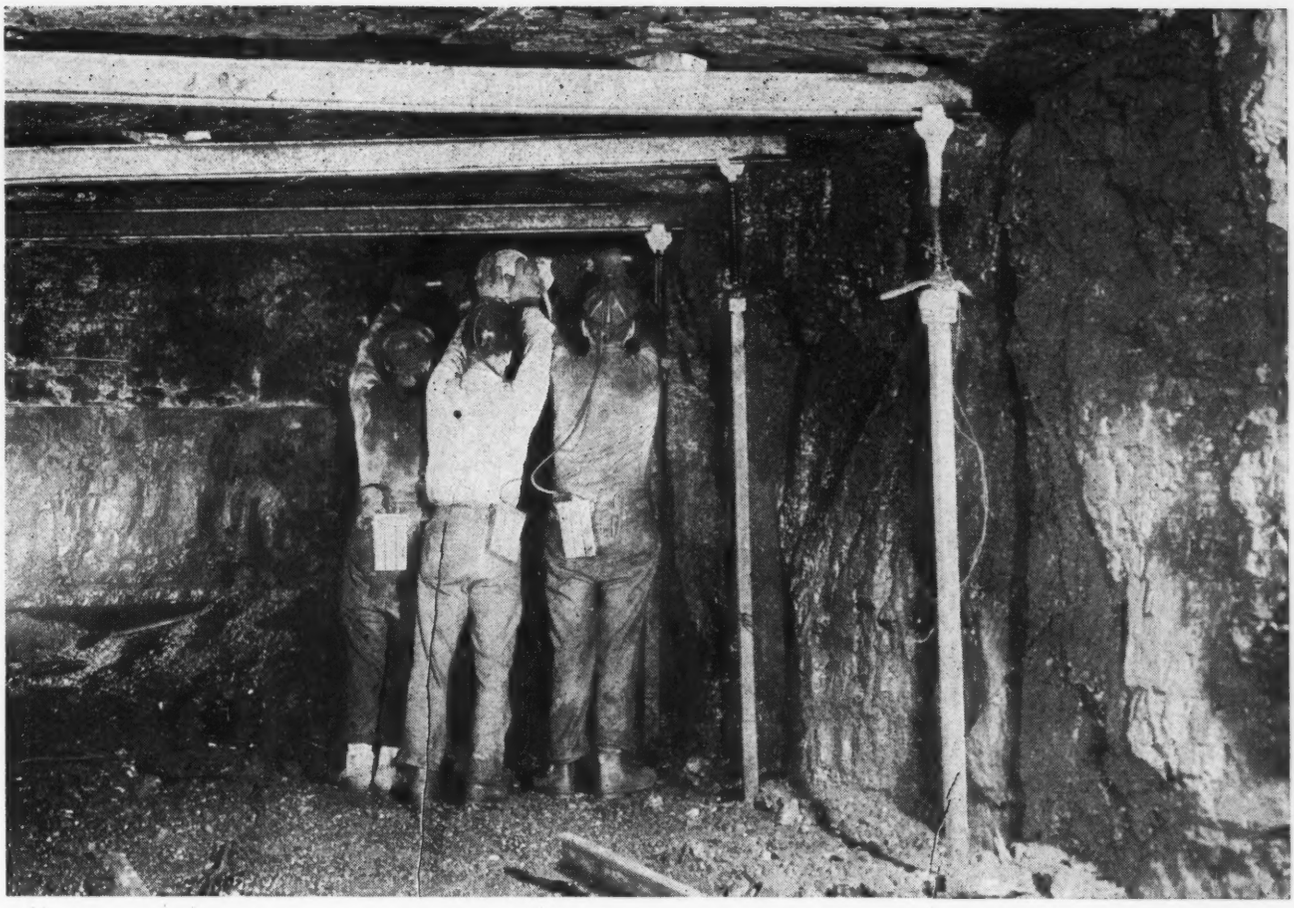
Blast-Hole Drilling. The year 1947 is interesting as the apex of the preceding decade and a half, in which a steady departure from earlier orthodox procedure has taken place. The past 15 years have seen, first, the long-established use of sharpened steel yield to drilling with detachable bits to an important extent. The diamond drill, next, has challenged the rock drill, at first for long-hole drilling and latterly for shorter rounds. Over the last ten years it has made a certain place for itself in blast-hole drilling, where special conditions permit, improving costs and safety, while accounting for a limited portion of the total tonnage broken.

Most recently, however, just as it seemed a stability of a sort was being reached between these two modes of drilling, tungsten carbide, a cutting medium with a spectacular wartime record in the machine-tool field, has made its entry into both percussion and rotary rock-drilling. Its performance has been amazing in places, not so good in others.

Carbide Bits. Opinion from various sources as to carbide-tipped bits may be summarized by saying they are expected to make good their promise eventually and, with further development, to be used

[1] See "Survey of Mining Progress—Parts I-IV," *E. & M. J.*, Feb., Mar., April, May, respectively, 1947.

[2] "Modern Methods and Equipment." *E. & M. J.*, Nov., 1947, pp. 92-132.



ALUMINUM ROOF SUPPORTS at a working face in Hubbard coal mine, Pennsylvania. Spaced 6 ft. apart, they provide a protected area for men and equipment. Note the pin timbering jacks.

Numerous Changes

for a large portion of rock drilling. In instances, they have already done exceedingly well. Meanwhile, on the whole, they need improvement.

For manufacturers and users of tungsten-carbide bits the year has been one of experimentation. The connection of bit to rod, the design and material of the bit itself, the composition of the carbide, and the method of attaching the insert are important variables that affect bit performance. For one company that has used approximately 500 four-point bits in testing in the last nine months of 1947, the problem centered at the start on three main points of weakness, namely, failure of the brazing material, the need for new tempering techniques for the steel in the bit, and the need for improving the means of attachment so that it would last as long as the rest of the bit. Up to the year's end, progress had been made respecting the first and second. The problem of bit connection remained the principal point of weakness. The attachment was responsible for 75% of the bit failures.

Long life is expected of a carbide bit in view of its cost. At the property referred to, the ratio of carbide-bit performance to that of detachable steel bits has varied from 30 to 1 to 60 to 1, whereas it is said it should be at least 100 to 1, for a carbide-bit cost of $13 against 13c. for one usage of the steel bit.

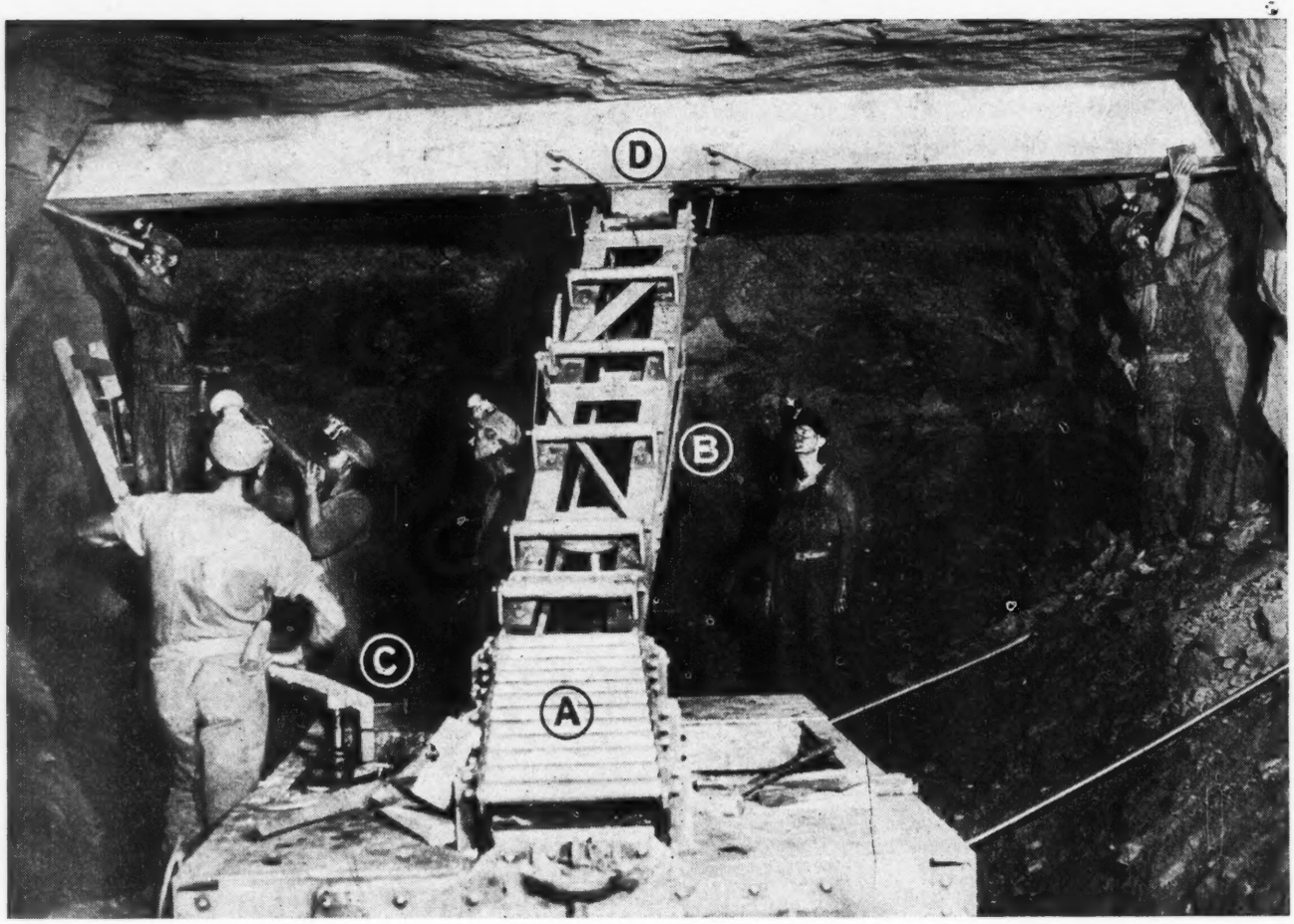
At this property, the four-point bit is used only in rock so hard that it cannot be drilled with other equipment. At the bit's present price it is thought it cannot compete in other ground in the mine with 1½-in. steel bits, these using a spud connection in combination with alloy-steel rods and tempering control.

At the same mine, the chisel-type, or two-point, bit is doing comparatively well. It is generally recognized that it will drill 17 to 30% faster than the four-point type. It has been found to give difficulty in collaring.

Opinions vary. Another company, which has been doing considerable test work, thinks the four-point cross bit the best all-around bit designed. Thus the situation in this country appears to be in a state of flux. Very recent word from South Africa is that the experience of the companies there also is varied. The bits are being assembled from parts imported from Sweden. Some bits are also being brought in from the United States. Hopes are being entertained that they will actually be produced in South Africa in the not too distant future.

Pressure welding of bit to rod in the United States is said to be successful, to judge from mine-test results that have been obtained. The procedure is said to be somewhat laborious as yet.

An Uncertain Situation. The promise of cheaper drilling held out by carbide-bit inserts has injected an element of uncertainty into the entire blast-hole drilling situation, so far as any effort to appraise it is concerned. However, it is worth noting that a bit manufacturer thinks that the carbide bit will not supplant the steel bit entirely but



TIMBER-SETTING TRUCK in a Birmingham iron ore mine. A, roller conveyor; B, boom, operated hydraulically by the pump C, and D, swiveled cradle for holding timber in desired position.

will be used as an accessory for certain types of drilling.

Several lines of tungsten-carbide-insert bits have been introduced during the year. They include Ingersoll-Rand's Carset bits, the Kennametal and Firth-Sterling lines, and most recently, the Joy company's Sulmet bit.[3]

Cleveland-Cliffs Iron Co., according to Grover J. Holt, chief engineer, has developed following data with Carset bits and standard bits in sinking its new Mather "B" shaft. Starter steel is 2 ft. long, followed by 4-ft. and 6-ft. lengths. Standard bits were 2¼-in. diameter (2-ft. length), 2⅛-in. (4 ft.) and 1¾-in. (6 ft.). Carset bits come at present only in 1½-in. size, so reground bits are used on 4-ft. and 6-ft. steels. Rock is very hard Marquette Range jasper. Bits are used with 60-lb. jackhammer.

Data

Standard round .....71 6-ft. holes
Drilling time, standard bits. 4 hr.
Drilling time, Carset bits... 2 hr.

	Standard	Carset
Ft. drilled before regrinding	2	112
Number regrinds	3	2
Total feet per bit	8	336
Original cost (approx.)	35c	$12.50
Bit cost per foot	4.4c	3.7c

[3]See *E. & M. J.*, Nov., 1947, p. 96.

Regrinding is done on silicon-carbide wheel, using slight pressure. Carset bit loses approximately 1/16-in. in gage. Latter bit in Maas and Spies underground mines has cut drilling time in development drifts from 4 hr. to 45-50 min. in extreme cases.

Hard Facing. Between the carbide-tipped bit and the older detachable bit in point of cost and performance is the hard-surfaced detachable bit. Important work is reported in the development of hard-surfacing material. Here two problems are involved—that of bonding the material to the bit, and that of heat treatment so that the surfacing material will not crack off and spoil the bit. A good welding rod for the purpose is said to have been developed. Bits surfaced with it will perform six to eight times as well as the unsurfaced steel bit. It can be easily applied to standard high-carbon steel bits and the tempering procedure has not been altered.

An Old Canadian Bit Crosses the Border

Manufacture of the Liddicoat throwaway detachable bit by Calumet & Hecla, under license from Thompson Products Co., of St. Catherines, Ont., has saved the company 50% in bit cost, it states, and increased the miners' drilling efficiency. In design, the bit is the same as the Canadian Liddicoat. Experience is needed to handle its push-on type of connection, also to process the bit end of the rod, which is made to tolerances of plus or minus 0.002 in. The C. & H. company makes the bit in one size only, suitable for the small-hole drilling practice followed in the district for 25 years, a practice that is said to have helped the district to survive. Under its license it can sell the bit in certain states. Most of its surplus is going to Anaconda. The latter company has adopted the bit not only for its mines in Butte but also for all its subsidiaries in this country, Mexico and South America.

The features of offset gage and flattened points developed at Britannia Mining & Smelting Co.[4] have been incorporated in the Hayes dovetail-type re-use bit by Hayes Steel Products, Ltd., Merriton, Ont.

[4]See paper by T. M. Waterland and G. E. apRoberts, *Transactions*, C.I.M.M., Vol. XLIX, 1946, pp. 123-129.

The Hayes company has also lengthened the skirt of the P. & M. throwaway bit, which it handles, from 5/8 to 7/8 in. to improve the shank life.

Handling of Rock Drills Easier, More Efficient

The place the jumbo has made for itself in improving drilling and breaking efficiency underground is well demonstrated pictorially in *E. & M. J.*, for November, 1947, p. 98. No less than six different models are shown.

Climax Molybdenum intends to use skid-mounted jumbos for drilling slusher-drift rounds and large jumbos in its large headings. Eagle-Picher is developing a lighter and more mobile jumbo than the one now used.

Use of long feeds has been an important development, especially in connection with carbide bits. Tests by Combined Metals Reduction Co., Utah, with long shells (4-ft. change) for drifter mountings in development headings, and fewer steel changes, show a saving up to 45 min. drilling time in the average round, over conventional mountings (30-in. change).

In *E. & M. J.'s* November issue is illustrated the way in which pneumatic columns and air-feed legs are being used to speed setting up.

Price of Bortz Versus Diamond-Drill Blasting

Despite a reported increase in the number of Canadian companies using diamond drills for blast holes, the weight of testimony given by interested individuals, including diamond-drill and bit manufacturers, indicates that the practice in general has suffered some curtailment. The idea has been put forward, moreover, that percussion drills using carbide bits and jointed rods may now be competing with diamond drills in long-hole work, and causing the recalculation of estimates previously made.

According to comment from the field, the quality of stones now used in bits and shells has improved greatly, compared with that too often supplied twelve months ago. The latter apparently came in with war conditions. In consequence, the footage drilled per bit and the cost per foot have improved for at least one company in Canada.

Construction of bortz bits of the cast-set type is receiving new attention. According to an Ontario user, "there is a gradual swing to the cast-set bit with a carbide matrix in preference to the copper or beryllium-copper cast-set type." A new line of coring and noncoring bits employing an allegedly superior, secondary abrasive, called Carbometal, has appeared. This material may be used in crystalline or in massive form, for each of which advantages are claimed.

As to the uncertainty, previously mentioned, caused by the introduction of tungsten-carbide, an engineer writes: "There is still a place for a really efficient high-speed electric drill underground, and there are several avenues open for research in long blast-hole drilling covering both machines and bits, which might have the effect of reducing costs and giving this whole drilling technique considerable impetus. However, the development of tungsten-carbide-insert rock bits may cause manufacturers to delay further experimentation on diamond-drilling techniques for long blast holes until they know how effective the new development in rock bits is going to be."

Fittings Standard Adopted

The revision of Diamond Core Drill Fittings CS 17-42 submitted to the industry by the National Bureau of Standards in 1946 was accepted during 1947. In its new form, it is known as "Diamond Core Drill Fittings (4th Edition) Commercial Standard CS 17-47." It became effective July 1 last.

Drilling at Josephine

The total cost per foot of blast-hole diamond drilling at the Josephine iron mine in Canada in 1946, recently published,[5] was $1.875 for 49,563 ft. drilled and 269,705 long tons broken. Total cost of breaking was $0.49 per ton. Of the $1.875, direct cost was $1.562, including $0.529 for direct labor and $0.785 for diamond bits. The difference of $0.313 between $1.875 and $1.562 was for mine pumping, compressed air, and general mine expense. During this period, the diamond supply was short and unstable, the price rising from $3.00 to $6.25 per carat. Rods, barrels and shells also were hard to get.

This drilling was done with CP-5 drills in sublevel caving and in benches or fans as conditions dictated. Holes 1 9/16 in. in diameter proved best. Average footage per 8-hr. machine-shift was 30, the maximum 112. Both coring and noncoring bits were used, according to the ground. Cost of explosives was $0.043 per ton broken.

[5] "Mining Methods at Josephine Mine." Alan E. Gallie, C.I.M.M., *Bulletin*, Nov., 1947.

Long Rounds in Headings

As a result of International Nickel Company's investigation of long (11- to 16-ft.) drift rounds, in which a large center-cut hole or two, drilling with detachable bits or diamond drills, was used, it is now standard[6] procedure in the company's mines to use cut of two holes drilled with 2¾-in. bits. Eventually, it is expected that a single 2¾-in. cut hole will supercede the two-hole cut. Feet-per-man-shift and powder consumption per-foot-advance have been bettered. Cut holes 6¾ in. and 4½ in. in diameter have also been tried experimentally. With them, it is thought, a still higher drifting efficiency may possibly be obtained.

Newer Things in Blasting

The most important developments in mining explosives in recent years are: (1) Ammonia gelatins and semi-gelatins have been found suitable for much work formerly done with straight gelatin. They have effected large economies, nitroglycerine being replaced largely by ammonium nitrate, said to give most explosive power per dollar of any known ingredient.

(2) High-grade ammonia dynamites, containing large percentages of ammonium nitrate, have come into general use in quarrying, stripping, and underground mining where work is reasonably dry. They are more granular and less water-resistant than gelatins and semi-gelatins.

(3) Use of pre-slit or perforated cartridges has been widely introduced, especially for boreholes slanting upward. Cartridges must be slit to stay in such holes.

(4) High-velocity gelatins have been developed, particularly for bulldozing and chute blasting where high-velocity detonation is wanted.

(5) Delay electric blasting caps with very short delay intervals, introduced originally in quarries to reduce vibration and improve fragmentation, have in general been satisfactory. They are also being used underground with promising results, though such experience is still too short to justify saying they are fully successful.

[6] "Long Rounds in Development Headings." Inco Staff. *Bulletin*, C.I.M.M., July, 1947.

Use of detonating fuse underground is increasing. For example, Climax Molybdenum blasts many plaster shots simultaneously with Primacord. It is also using so-called igniter chambers for stick-bundle shots.

The duPont blasting timer has already been described.[7]

A multiple-shot blasting unit for firing ten detonators in series has been developed by the Bureau of Mines[8] for coal mining where there may be a gas hazard. It is based upon the utilization of the discharge energy from a capacitor charged to a given voltage and having capacitance adequate to store energy for initiating ten detonators in series. The primary source of energy that is employed is a 4-volt cap-lamp battery.

At a Minnesota iron mine, specially made powder, in 2x16-in. and 1¼x24-in. sticks, has been tried in an effort to improve breaking efficiency through using fewer, larger holes. A saving in loading time results, but other problems are reported to remain.

A saving in powder of 50% by weight has been made recently by New Park Mining Co., Utah, by blasting two test, drift rounds with a 75% nitroglycerine powder made up in ⅞-in.x4-in. sticks. High fumes resulting would limit this powder to a well-ventilated place. No extensive use of this explosive is planned.

Loading Practice Highly Mechanized

Illustrating the current changing loading practice, McIntyre Porcupine handled 76.1% of its ore, waste and fill underground mechanically in 1946 compared with 17.1% in 1940. Bunker Hill & Sullivan, another example, is making greater use of mechanical loaders and scrapers in both headings and stopes. Instances are numerous where labor shortage has promoted mechanization. Eagle-Picher is successfully using its crawler-mounted, diesel-powered loader. It also has a diesel-powered, crawler-mounted loader with a bulldozer attachment cleaning up old ground. It is also trying to design a combination loader and truck.

The folding scraper[9] developed by Climax Molybdenum Co., the use of which is now standard practice with the company, has been taken over by the Eimco Corporation. Climax is now scraping in only one direction from a permanent hoist set-up, rather than from two directions with a movable set-up. Its portable scrapers are being replaced by mechanical loaders.

Mechanical Mucking Gains in Shaft Work

Mining companies using the Riddell clamshell[10] shaft mucker, during 1947, included Eureka Corporation, Nevada; Lake George Mines, Australia; Hecla Mining Co., Idaho; and Pickands, Mather & Co., Michigan.

New Park Mining Co., Utah, has built and is using a shaft-mucking machine utilizing the Boskovich patent. As described, it employs a power-shovel bucket with an air piston for providing the crowding action. It is hung beneath a cage which runs in the center compartment of the company's Mayflower shaft. Three air hoists operate the bucket and a fourth hoist operates the cage. Refinements of design are planned.

Calumet & Hecla has lowered shaft-mucking costs appreciably by mucking an inclined shaft with scraper and ramp. Inclination is 31° to 38°. The bucket is handled by a trolley carried on an I-beam which is supported by "eye-pins" driven in the hanging or hung from the shaft timber if timber is used for ground support.

The practice of loading cars from stope chutes has given way in several mines to mechanical loading, the chutes being removed and the ore allowed to run on to the level where it is shoveled up by mucking machines. Employed in the Golden Manitou, near Val d'Or, Quebec, some years ago, it is now used elsewhere, the known mines including the Copper Canyon, in Nevada, and that of Canadian Refractories, Ltd., Kilmar, Que.

In the last-named property, the mucking machine draw-point system is being used in connection with a 90x400-ft. stope. Haulage drifts are run each side of the orebody, with switch tracks in to the mucking points, which are spaced 35 ft. apart. One Eimco 21 loader is used on each side. Breaking in the stope above is done in flat slices diamond-drilled in fans from inclined raises driven on the contacts. The chief advantage here has been the reduction of ore tied up in grizzly-and-boxhole layouts which is hard to recover, inasmuch as a waste mat is being carried down from surface. Hang-ups in draw holes are fewer because there are less obstructions for over-size fragments. When they do occur, the ore can usually be made to move by mucking at an adjacent point. This has cut powder consumption for secondary blasting, with "bombing" eliminated.

It should be mentioned that chute loading was abolished some years before at the Montreal iron mine, on the Gogebic Range, by removing the chutes and letting the ore run into a transfer drift above the main haulageway and scraping it into the cars below.

Joy Loader Redesigned for Heavy, Abrasive Ore

At an underground iron mine, a new Joy loader model, 18-HR, has been applied to mucking iron ore. In basic design it is like the 11-BU high-capacity coal loader which has also been used with success to load salt, gypsum, potash, bauxite and other materials, these being neither very abrasive nor very heavy. The two major changes from the 11-BU, aside from strengthening the whole machine for extra weight and more severe service, are:

1. The loading head, conveyor pan, and conveyor pan section are armor-plated. The armor plate is spot-welded so that it can be replaced readily in the field as it wears out.

2. The chain conveyor has been strengthened to withstand the heavy weight of the iron ore. Unlike other loaders of this make, the 18-HR conveyor chain is driven from the discharge end by two motors integrally geared together and mounted on the rear conveyor. These work through propeller shafts to right-angle worm gears which drive the conveyor sprocket through a friction clutch. The propeller shafts are splined to allow the conveyor boom to swing from side to side of the machine.

The new model has a rated loading capacity of 150 cfm. and a machine capacity of 300 cfm. (400 cfm. under ideal conditions). It comes in all standard voltages and is self-propelled, crawler-mounted and loads continuously. Conveyor swing, elevating and lowering are hydraulically operated, likewise the elevating and lowering of the gath-

[7] *E. & M. J.*, Nov., 1947, p. 121.
[8] U. S. Bureau of Mines, R. I. 4136, Oct., 1947.
[9] "Survey of Mining Progress—Part I." *E. & M. J.*, Feb., 1947, p. 97.
[10] *E. & M. J.*, Nov., 1947, p. 105. Also "Survey of Mining Progress—Part I," *E. & M. J.*, Feb., 1947, p. 98.

ering head, and the conveyor clutch engagement.

Other specifications are: Overall loading height, 5 ft. 3½ in. Overall tramming height, 5 ft. 6 in. Overall width, 6 ft. 4 in. Overall length (standard conveyor) is given as 25 ft. 4½ in.

The main motor is 75 hp., that on the hydraulic pump 4 hp., and the conveyor drive motors are each 7½ hp. The machine has two forward speeds and two in reverse.

Shuttle Car Redesigned for Heavier Work

The design of the shuttle car used in the iron mine with the loader just described did not have to be greatly modified to handle heavy abrasive ore. The standard 60-E car had been previously modified to withstand service in limestone mining. This car had heavier plate and heavier chain and flights on the bottom than the coal-type shuttle car of the same size. The only change necessary to convert the limestone car into a shuttle car suitable for iron ore was a change in capacity. The sides were cut down so that no more than 14 tons of ore could be loaded into the car. This prevented overloading the axles.

This car is also provided with a new-type hydraulic cable-reel, which functions automatically and keeps proper tension on the cable regardless of direction of travel. It is unaffected by voltage variations and eliminates the bulky resistor cases, electric motors and switches required for electric-driven reels.

A heavy-duty, cable-reel-type Joy shuttle car, installed last July in one of the mines of the American Zinc Co. of Tennessee, is reported to be working satisfactorily on grades under 12%. It is 42 in. high with 6-in. sideboards and is equipped with 250-v. d.c. hydraulic steering. Additional cars are to be installed. Two loading ramps (for scrapers) with rubber-tired wheels are being tried.

A New Application of Diesel Haulage

To the installations of diesel engines underground already recorded may be added the 3-ton locomotive acquired for a California tungsten mine, the diesel-driven loader provided in the Bureau of Mines oil-shale mine in Colorado, and the equipment installed in a dam tunnel in Pennsylvania. For such use, exhaust conditioning is necessary and the underground ventilation must be good. An Allis-Chalmers tractor recently installed by Eagle-Picher in the Tri-State District is equipped with an oxygen bottle to take care of the exhaust gases. An overseas user of diesels points out that a well designed air filter also is desirable, or a relatively dust-free mine atmosphere.

A cadmium-nickel alkaline storage battery, used in Europe for 20 years, is being produced by Baker & Co., Newark, N. J. It accepts high or low charge rates with no finish limitations and has excellent capacity at low electrolyte temperatures. Its use in mine locomotives is not recorded as yet.

Trammer locomotives of the Mancha line are now equipped with a new spring suspension which permits higher speeds than hitherto on rough track.

Bunker Hill & Sullivan mechanics have redesigned the shock-absorbing equipment on electric locomotives to resist horizontal shock when cars are being coupled. This is said to have virtually eliminated broken axles and damage to bearings. Springs are generally used to resist vertical shock only.

Mine Rails Welded

Bronze welding of mine rails, pioneered (it is believed) by Linde Air Products Co. in 1938, is being extensively used in the coal industry today, over 70 miles of track so welded being recorded. More than half of this has been in use since 1943. Advantages claimed include better conductivity through the joints, smoother riding, lower track maintenance, safer and faster main-line haulage. In cost, bronze welding compares favorably with that of angle bars, bolts, copper bonds and labor used in conventional bolted track.

The Linde company has found it necessary to use expansion joints (which it has designed) at 300- to 400-ft. intervals when welding rail outside the mine to prevent buckling or distortion with temperature changes. The spacing depends on the amount of curve. Such joints are unnecessary inside the mine.

Telephone communication between dispatcher and motorman on trolley locomotives is a current development that improves efficiency and safety. See *Coal Age*, Nov., 1947, pp. 101-102. Also *E. & M. J.*, Nov., 1947, p. 108.

Climax Molybdenum is making increased use of central traffic controls underground. Many main switches are electrically controlled by push-button from a central station by a dispatcher through a telephone and buzzer system. Switch position is shown by lights on a board. Electric eyes record the location of trains in given areas.

The Conveyor Underground

Little can be added to that already said[11] about underground conveyor transport. Recently, the Goodman company introduced a belt conveyor having a frame of channel construction and securely bolted together, which is intended for heavy duty in main haulage or for gathering service where large capacity and high speed are wanted. A special joint construction facilitates following an undulating bottom without misalignment sideways.

The Pennsylvania anthracite field will see the first installation of United States Rubber Company's new Ustex-nylon belt, the strongest made, according to the manufacturer's claims. Whether this is an underground or surface installation is not divulged. It will be 2,600 ft. long between centers, with a 630-ft. lift at 15 deg.

Republic Steel completed a belt conveyor installation in November for moving ore from the stopes to the mine cars in its Tobin mine, Crystal Falls, Mich.

Plans are being made for further development of the shaker conveyor as applied in metal mines, with possibly marked changes in design of both trough and drive. In certain present installations, larger drives are being substituted to correct previous overloading.

Steel, Aluminum for Ground Support

Use of steel posts and caps and steel-rail matting for ground support in top-slicing in the Cyprus Mines Corporation's Mavrovouni copper mine was described by J. L. Bruce, G. W. Nicolson, and J. G. Tate at the Los Angeles meeting of the A.I.M.E., Oct. 24, 1947. Steel was adopted to obviate the fire risk that might otherwise be caused by the presence of sulphide in the overburden if the customary timber mat

[11] "Survey of Mining Process—Part II," *E. & M. J.*, March, 1947, p. 67. Also *E. & M. J.*, Nov., 1947, pp. 106-107. Also "Continuous Ore Transport." R. W. Rausch, *Mining and Metallurgy*, Dec., 1947, pp. 590-595.

were used. Thirty- to 35-lb. rail in 5-ft. lengths is spaced 12 in. apart, one long ton covering 162 sq.ft. of floor area. Posts are 8-ft. 3-in. lengths of 5x6-in. I-beam weighing 25 lb. per ft. with riveted pieces of angle iron to support the collar braces. The latter consist of 3-ft. lengths of 2- or 3-in. pipe. Caps are 4-ft. 7-in. lengths of rail weighing 90 to 110 lb. per yd.

For 1,796,136 dry tons mined, steel rail matting cost 3.98c. per ton; rail caps 0.262c., and steel posts 0.715c. The total cost of steel used was 4.957c. per ton.

Aluminum is being used for roof support at working faces in the Hubbard coal mine, McKeesport, Pa. An accompanying picture shows 4-in. aluminum-alloy H-beams employed in a set of three, on 6-ft. centers. The 15-ft. beams weigh 70 lb. each compared to 200 lb. for a 6-in.x6-in.x14-ft. timber.

Increasing use of the timber-setting truck illustrated is reported. It is shown in an ore mine of Tennessee Coal, Iron & R. R. Co. In operation, the timber is rolled along the conveyor to the end of the boom and clamped in place in a cradle on the end. The boom is then raised hydraulically by the hand pump to the roof where the timber is anchored on rib pins. A ratchet prevents the boom from dropping, in case the pump fails.

Climax Molybdenum is planning a timber jumbo for large headings. This will have a lifting device to handle posts and caps, also working platforms and space to carry timber and tools.

Army landing mats are being used for lagging and chute lining by Combined Metals Reduction Co., Utah.

Ventilation

Use of spot coolers in air conditioning is expected to increase. Bunker Hill & Sullivan is employing them to supply air to dead-end development workings in general in its property.

A change in the ventilation system at Hecla Mining Co.'s 3,000-ft. Silver Summit shaft involved replacement (last September) of 22-in. galvanized pipe, ventilated by fans, with 30-in. (inside diameter) wood-stave pipe 1½ in. thick. Conditions after and before are compared in the accompanying table. The shaft collar is 5,200 ft. from the portal of the connecting adit. Crosscutting is underway at the bottom on two shifts at two faces.

A new ventilation system using pre-heated air is being provided in Republic Steel's Penokee mine at Ironwood, Mich.

The outstanding new development in air conditioning is the new "Butte-type" cooling system being installed by Magma Copper Co. to supplement its present system. This was described pictorially in the November, 1947, *E. & M. J.*, pp. 116-117.

Comparison of Ventilation Conditions, Silver Summit Shaft, Before and After Changing Pipe on September, 1947

	Nov. 7, 1947, (After)	June 16, 1947 (Before)
Air entering adit at portal	23,500 cfm	2,000 cfm
To Polaris past Silver Summit crosscut	1,500 cfm	aspirating
Upcast in raise to exhaust adit	22,000 cfm	slight
Downcast in shaft duct at collar (volume)	13,000 cfm	1,540 cfm
Downcast in shaft duct at collar (temp.)	58° 54°	60° 59°
Upcast in shaft at collar (volume)	13,000 cfm	1,540 cfm
Upcast in shaft at collar (temp.)	68° 68°	80° 80°
Grains of moisture per cubic foot at collar	7.5	11.0
Hoist room vicinity of stand	64° 61°	83° 81°
Transformer room centerline	66° 62°	84° 82°
3,000 Silver Summit station	77° 76°	85° 85°
Grains of moisture per cu. ft., 3,000-ft. station	10.0	13.0
Exhaust air from south crosscut near 3,000-ft. station	82° 78°	85° 85°
Auxiliary ventilation discharge near south breast	77° 67°	85° 84°
Face of south breast from 3,000 station, ft.	1,600	950
Ground water, south crosscut	90°	90°
Heat extracted from mine in tons refrigeration per day	43.5	12.3
Excess air to 3,000-ft. station from duct	66° 57°	

Galvanized Hoisting Rope for Corrosion

To combat an acid-water condition, which was causing internal corrosion in its hoisting[12] ropes and to lengthen rope life, the Montreal Mining Co., on the Gogebic Range, has been using a galvanized rope since January, 1946. As far as can be ascertained, it is doing as well as can be expected. It is a 6x19, 1¼-in. diameter, Warrington-construction (Bethanized) hemp-center rope, 5,200 ft. long, made by Bethlehem Steel Co. The affiliated Castile Mining Co. is using a similar rope.

The skip hoist at International Minerals & Chemical Corporation's potash mine, Carlsbad, N. M., has been made fully automatic. This is expected to increase the tonnage hoisted, already raised by adoption of direct current.

Calumet & Hecla is among the companies that have adopted a combination high-frequency electronic man-cage signalling system. Supplied by R. L. Rutherford, of Superior, Ariz., it is said to be simple to operate and maintain. An efficient system should increase safety in hoisting and speed shaft-maintenance work.

The two-way shaft communication system utilizing the hoisting rope which is employed by Homestake Mining Co. was described in *E. & M. J.*, Nov., 1947, p. 110.

An electronic shaft-communication system between shaft stations, loading pockets and hoistman is used by Combined Metals Reduction Co., Utah. The company also has an automatic Otis elevator in its main service raise.

Power Distribution Ingenuity

At the aforesaid potash mine in the Carlsbad, N. M., district, the a.c., slip-ring hoist motor was replaced by a d.c. motor, supplied by an m.-g. flywheel set. This was done, according to James A. Barr, International's chief engineer, to eliminate the surge caused by the a.c. motor, this being necessary because of a tie-in with the local public utility for the company's major supply of power during the year. In the new hook-up, the load was divided into two parts, namely, an essential "must go" and the rest of the load which could stand an outage. The "must go" load included such items as the large thickeners which cannot stand still for over a minute or two without plugging and would require four to six hours to be washed out and started up again. On an outage from the utility, electronic controls on the board throw off the non-essential power, disconnect the company's diesel plant from the

[12]For other up-to-date developments in hoisting, see *E. & M. J.*, Nov., 1947, pp. 111-115. Also Survey of Mining Progress —Part II, March, 1947, pp. 67 and 82.

utility's lines, and connect the essential load to the diesel plant which always runs. Should the latter have to shut down, the reverse switching takes place.

The new hook-up is satisfactory. The company's main distribution has been changed from 2,300 v. to 13,000 v. primary between the utility's substation and the mining company's secondary substation. Secondary distribution remains at 2,300 v.

In Idaho, 13,200 v. is being carried through the two-mile Kellogg tunnel and to the bottom of the mine through the 4,000-ft. shaft. Substations for stepping it down are provided at the collar and on the lowest level.

In the McIntyre mine, Ontario, all underground power cables are being replaced with cables of fireproof type.

Pumping Practice Marked by Few Changes

Most mine water today that is lifted to surface is handled in multistage centrifugal pumps. Submersible turbine and deep-well pumps offer these their principal competition. Modernization of the pumping layout is still a prime need in many mines. Proper sump construction aids cleaning. A gravity head on a pump insures against loss of priming. A ditch-cleaning machine,[13] recently developed, should fill a long-felt need. The need for cleaning ditches has always been a nuisance.

Surface Mining Shows Changing Practice

Open-cut mining has been discussed rather fully during the year.[14] The following added items reflect current trends:

Drilling. A Mesabi operator has new-model 6-in. pneumatic blasthole drill on order, for work competitive with churn drills.

Twelve-inch churn-drill holes are proving superior to 9-in. holes at a Southwestern copper mine. The spacing can be increased and a bigger toe burden used. This gives more tonnage per foot drilled, and more broken ground per shot.

Steep Rock Iron Mines, western Ontario, has switched from gas-engine churn drills to electric units.

"Jet" Piercing. Laboratory and field experiments have produced a major process change in fusion piercing, renamed "jet piercing," according to the Linde Air Products Co. Oxygen and a liquid petroleum fuel were combined to produce an extremely high-velocity flame. This proved very satisfactory for piercing blast holes in a variety of materials, including several types and grades of iron ore and such rocks as coarse granite, quartzite and dolomite. The performances in iron ore recorded showed an overall increase of more than 100% over the piercing rates recorded during the 1946 field experiments. The 1947 tests were in the nature of a production performance rather than of field research. Much of the piercing was done by semi-skilled labor who, after a few hours training, were able to operate alone and produce penetration rates equalling those obtained by the company engineers in charge of the work.

An important new development in the equipment was the use of a portable piercing rig about the size of a wagon drill. Demonstrations were made with this purely experimental equipment, the blast holes being in all planes from the vertical to the horizontal.

The major technical hurdles appear to have been overcome and there is strong likelihood that the first commercial forms of equipment will be in actual operation by late summer of 1948.

While the piercing application work was underway, other engineers of the company were studying the particular needs of the open-cut mine and the quarry from the standpoint of oxygen distribution needs. This problem has now been solved.

Blasting. High-strength, low-density, free-running ammonium-nitrate powder is giving better fragmentation and less heave in a New Mexico mine. In wet holes, 8x22-in. cartridges of high-strength, water-resistant semi-gelatin dynamite are giving rapid shattering and little heave. A small bulldozer has proved a time saver when stemming holes.

Excavation. An Iron Country operator is experimenting in loading directly with a dragline to a hopper, from which, in turn, trucks are loaded. The company is also using a dragline on Cuyuna stripping, the first to be used on that range for loading.

Transport. The operator just mentioned is also drawing plans for using belt conveyors to transport stripping material, which will be loaded on the belt by dragline. Devices for cleaning truck boxes in cold weather are being tested. Experimentation is also under way with attachments to tractors for ditching and grading.

At a Mesabi pit, three 19x26 steam locomotives, hauling four 16-cu.yd. dump cars, are being replaced with four Model-AWVD, 300-hp., butane-burning, Walter trucks hauling 16-cu.yd., 35-ton Austin-Western side-dump trailers.

Steep Rock Iron Mines is starting to replace its entire fleet of 15-ton trucks with 22-ton units. It is also completing designs for a conveyor system from the pit to the loading terminal 4,000 ft. away.

A unique open-cut mine conveyor system[15] will be the 42-in. line, 4,000 ft. in belt length, which will bring coal from the Glenbrook mine, Big Stone Gap, W. Va., to the preparation plant on the railroad 1,300 ft. below, at minus 16 deg. 50 min.

The past season on the Mesabi saw the fifteenth conveyor system for that range installed at the Embarrass mine on the east end. It is loaded by truck in the pit. Conveyor length[16] is 1,758 ft., width 36 in., vertical lift 354 ft., inclination 12 deg. Its capacity is 900 long tons per hour at a speed of 500 fpm. It consists of three belts.

Still another belt system is the two-stage line installed at Holman-Cliffs mine. Total inclined length is 1,782 ft., and the lift is 327 ft., ignoring surge bin depth. The belt from pit to surge bin is of No. 100 Compass Cord Cable construction and 1,818 ft. long; that from bin to washer is 1,843 ft. long and of like construction.

Euclid's most important recent change in its standard truck models is its trunnion-mounted front axle (p. 125, *E.&M.J.*, Nov., 1947).

In a large open-pit copper mine in South America, tests are being made to determine the most suitable equipment for radio communication between chief dispatcher and locomotive engineer.

Acknowledgment

I am indebted to many individuals and companies in the industry for information and opinions that have assisted in preparing this summary.

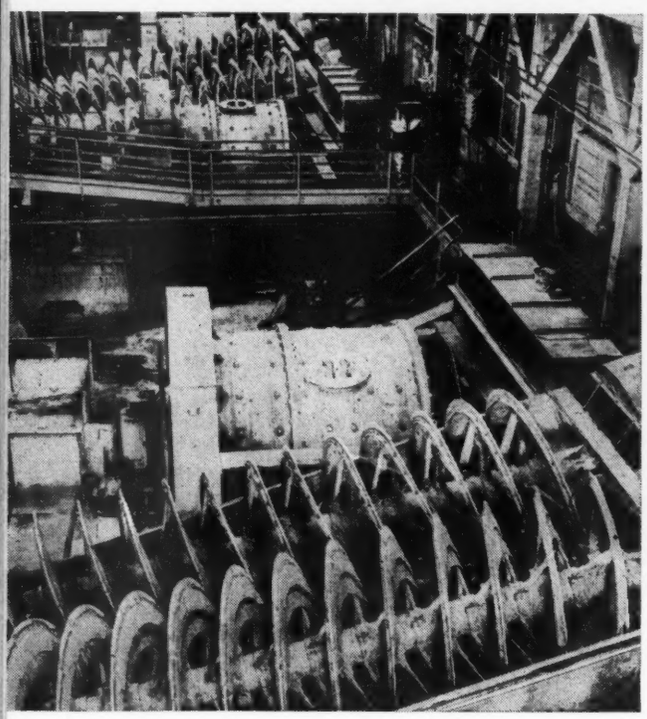
[13]See *E. & M. J.*, Nov., 1947, p. 110.

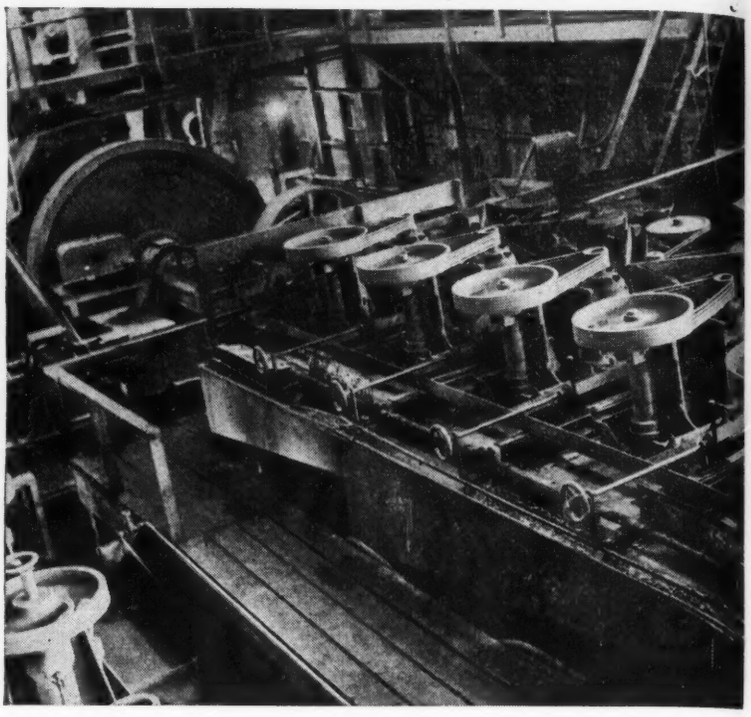
[14]See "Survey of Mining Progress—Part IV," *E. & M. J.*, May, 1947, pp. 72-75. Also "Iron Country Mine Operators Press for Maximum Tonnage," *E. & M. J.*, Sept., 1947, pp. 84-85. Also, *E. & M. J.*, Nov., 1947, pp. 119-126.

[15]Mining Congress Journal, November, 1947, pp. 24-25.

[16]*Skillings Mining Review*, Sept. 6, 1947, p. 1.

Research by Mining Companies

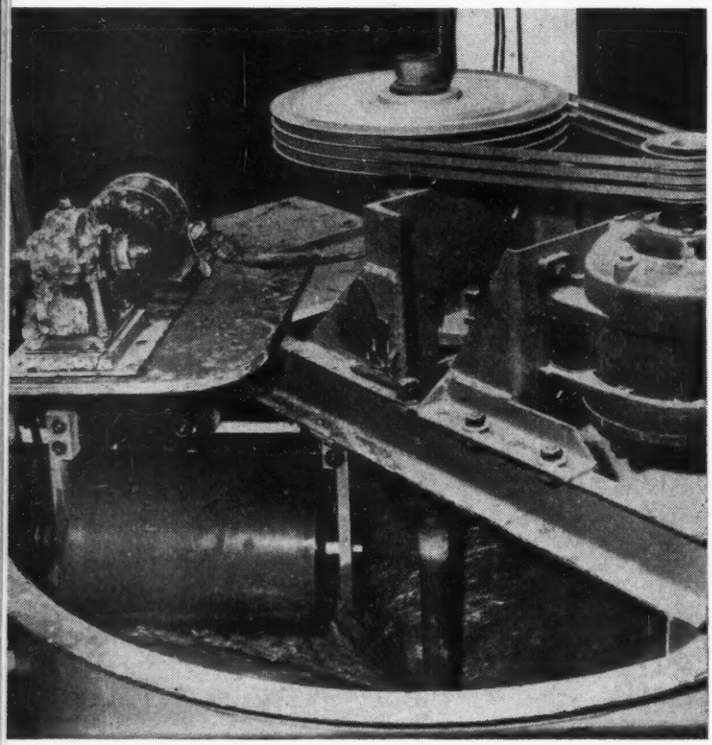




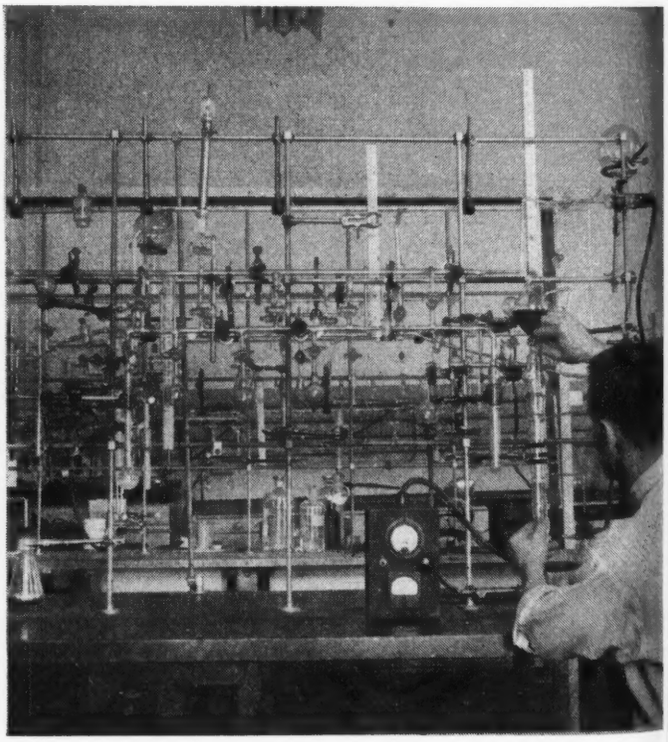
GRINDING AND FLOTATION need more study. Climax, left, gathers data on ball milling by extensive mill testwork. Idarado, right, has tested several flotation machines, finds that some make better roughers, others do better at cleaning.

Research and Development

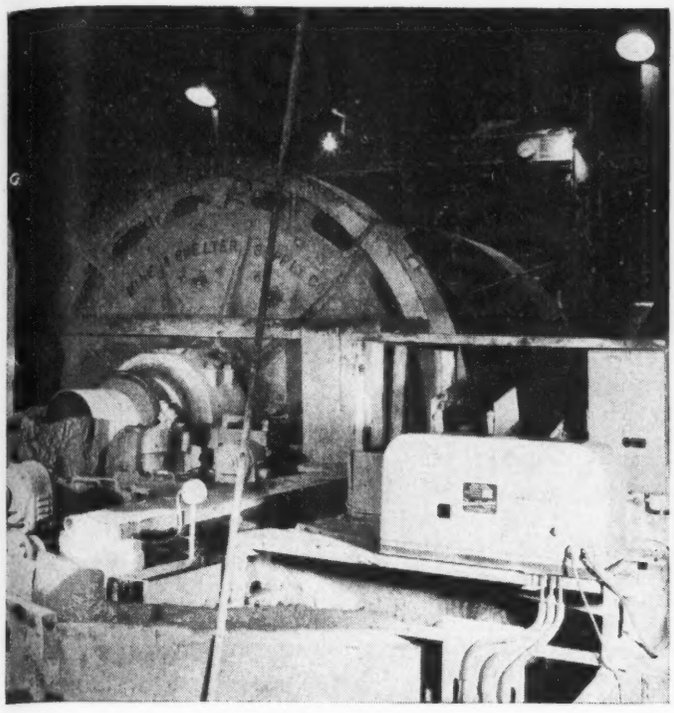
Research by Institutions



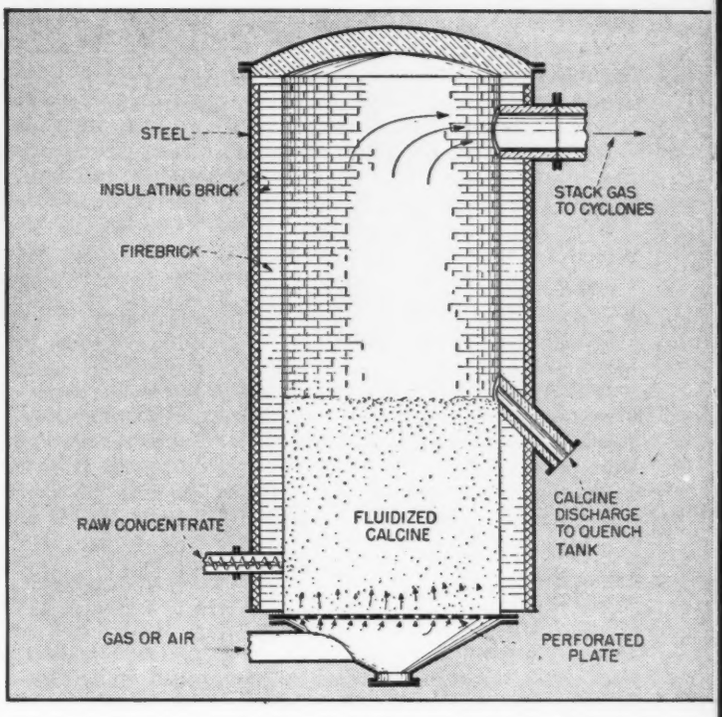
ACTIVATED CARBON tumbles in screen dipped in agitated cyanide pulp, picks up gold. Chapman, Arizona Mines, and Hardy, of Getchell, evolved method in Tucson lab.



RADIOACTIVE CARBON will be used at M.I.T. as tracer to study surface phenomena in flotation. F. W. Bloecher adjusts apparatus for counting discharges from samples.



AUTOMATIC control of grinding gets close study. This is Massco's Circuitron, developed in Telluride mill.



FLUOSOLIDS process, developed by Dorr Co., may revolutionize roasting. It offers small space, fast work.

Open New Phase In Milling

Lower grade ores, rising costs, place greater burdens on milling. To meet responsibilities, millmen step up drive for basic knowledge, better operating methods.

R. H. RAMSEY
Associate Editor

MILLING CAME OF AGE in 1947. The facts assembled for this review show clearly that most millmen made up their minds last year to have done with the cut-and-try methods of the past. They have gone actively to work to build milling into the man-sized operation it ought to be, based on exact knowledge, and complete with the best in modern industrial and scientific techniques.

The most interesting aspect of this new vigor in milling is that each millman, if questioned, would probably indignantly deny that he had reached any such conclusion, or that he had any such highfalutin ideas. Yet the combined effect of all the individual decisions and actions of millmen this past year has undeniably given milling new stature and great promise. If proof were needed, there is the fact that the A.I.M.E. last year accorded full divisional status to the one-time Milling Methods Committee.

The most obvious effect of this drive for betterment in milling is the increased emphasis on research throughout the industry. Several iron mining companies have set up fine new laboratories, or have financed research in others, to help with the rapidly approaching taconite problem. All the older, established laboratories have been offered more work than they can handle. And in mills all through the industry, men are working earnestly to find out which liner, which reagent, or which instrument can do the most for them. Here are two examples of the sort of research that mining companies can, and should, do that seem to deserve special emphasis as good illustrations.

First, there is the work constantly being done at Combined Metals Reduction Co. to turn out a top-notch job of milling. C. M. Marquardt, who works out electronic devices for Combined Metals, reports that "in 1947 we developed and placed in operation an entirely new automatic electronic pulp density meter.

"One such apparatus is capable of measuring pulp density in several places in the mill and recording the data on a single strip chart. Thus, just as we have utilized pH data from several places on one chart, we will be able to get a picture of the pulp density in several places on one record. Correlations that are otherwise impossible become readily apparent."

Second, there is the research now under way at Tennessee Copper Co. to find out more about oxygen-sulphur reactions in flotation and to develop even more of the automatic controls for which Jack Myers and his mills are noted. F. M. Lewis, assistant mill superintendent at Tennessee Copper, has kindly given us this note on that research:

"In milling sulphide ores, oxida-

tion takes place on the sulphide surfaces, and a number of sulphur-oxygen compounds are formed. These have a marked effect on flotation, but we do not know why. Apparently they take up space on the sulphide surfaces at the expense of the xanthate.

"The only way we have ever corrected for this oxidation is to use an excess of xanthate, and then it must crowd the sulphur-oxygen compounds from the sulphide surfaces by mass action. Of course, this is an expensive corrective, and also the xanthate must be accurately controlled in order to maintain proper selectivity.

"We know neither the chemical behavior of these sulphur-oxygen compounds nor which ones interfere most with the xanthate adsorption. At present, we are analyzing filtrates from pulps for these salts, and studying the conditions that cause them to change to other forms. The captive bubble machine and the laboratory flotation cell are used in this work.

"We use a polarograph to analyze quantitatively the amount of xanthate left in solution. We hope to find out just how much excess xanthate is needed for different quantities of the various salts, and then automatically control the xanthate with a polarograph."

These two examples, from Nevada and from Tennessee, show better than anything else we could say the freshness and the vigor of milling today.

The New Things

Here are brief reports on several new processes that became established in 1947, or on which significant progress was made.

Fluosolids is the name given to the Dorr Company's metallurgical adaptation of the fluid catalyst technique worked out by Standard Oil Development Co. for cracking crude oils. Developed by the Dorr Company for roasting and calcining, the process is of tremendous importance to the mining industry.

The Fluosolid technique is now being tested on roasting zinc sulphides and a number of other applications. A Fluosolid pilot plant has been running for over a year at a mine up in Canada, where it roasts a gold-bearing arsenopyrite concentrate. Following the roast, the product can be cyanided and the gold recovered as bullion. For further information, see *E. & M. J.*, November, 1947, p. 156, and *Chemical Engineering*, December, 1947.

The Chapman process, which uses charcoal to precipitate gold out of cyanide solutions, is steadily gaining strength. In a pilot plant at the Getchell mine, Redhouse, Nev., the process has been given an interesting modification, and last year it produced remarkably good results.

Professor T. G. Chapman, dean of the University of Arizona's College of Mines and originator of the process, kindly sent in this discussion of developments at Getchell.

"The original process used simultaneous dissolution and adsorption of gold in continuously agitated cyanide pulps with activated carbon. Flotation removed the carbon from the pulps after adsorption was complete.

"The first modification eliminates agitation and allows adsorption of the soluble gold in a thick stagnant pulp by migration of the gold ions to the activated carbon. After adsorption is complete, the carbon, if finely divided, may be recovered by flotation, or if the carbon is coarse, it may be recovered by screening. Eagle-Picher successfully operated a 25-ton pilot plant with this method for several years at Harqua-Hala, Arizona.

"The second modification, which is now running at Getchell, again uses simultaneous dissolution and adsorption of gold in an agitated pulp. The activated carbon, however, is confined within a revolving screen partially submerged in the pulp. This modification eliminates the necessity of recovering the carbon from the ore pulp after adsorption is complete.

"This method was worked out at the University of Arizona by Royce A. Hardy, of the Getchell staff, and myself. The Getchell 100-ton pilot plant is now in successful operation." (See *Mining Congress Journal*, November, 1947, p. 42.)

Since the Mining Congress article was written, work has been still further improved, and barren solutions assaying a trace are now regularly reported. George Wingfield, president of Getchell, says of the method that it "seems to be one answer where very bad settling and filtering difficulties arise in treating gold ores." A further advantage, of course, is that because the gold is picked up by the carbon right out of the agitators in which it dissolves, no thickening or filtering is required.

From Australia, via McGraw-Hill World News, comes word of another process for recovering gold from ores high in primary slime. Developed by Orville J. Parker, manager of Ora Banda United Mines, Ltd., Western Australia, the method involves feeding the ore pulp forcibly onto the surface of a revolving drum coated with an adhesive that has a selective affinity for gold particles. This surface is then sprayed with water containing a wetting agent, and the gangue is washed off the drum.

As the drum rotates farther, the gold-bearing adhesive is shaved off to be burned for recovery of the gold. Still farther along in its rotation, the drum is again coated with adhesive by a feed roller similar to those used in printing. A 100-ton pilot plant has been running for some time at Ora Banda using this process.

Gold in old tailings is being recovered successfully at Wiluna Gold Mines, Ltd., Western Australia, by a novel chloridizing process. The tailings are cyanide residues of roasted flotation concentrates, and they contain considerable gold locked up in particles of Fe_2O_3 formed during the roast.

The tailings are pulped with carbonaceous matter (sawdust), a source of sulphur (pyrite), and large amounts of a soluble chloride (NaCl). The pulp is filtered and roasted in eight Edwards furnaces at about 800 deg. C.

The gold in these calcines can then be recovered by cyanidation. This process is the subject of international patent applications in the name of A. F. B. Norwood.

International Nickel has a new smelting process to separate copper and nickel sulphides in matte that involves flotation. Professor Hayward's article on non-ferrous metallurgy on page 116 gives the few details that are available.

Crushing

Although there was no single outstanding development in the field of crushing in 1947, it was evident from discussion at various meetings that crushing is not being neglected. Principal developments last year included: more attention to proper feeding of crushers, particularly in smaller plants; design of crushing plants for as near automatic operation as possible; and testwork aimed at finding out how far into the territory of the tumbling mill the crusher can go.

Crushing equipment in the new Bunker Hill mill is larger than that formerly used. The crushers in

the new Magma mill are all on one level. These things are in line with the trend noted last year to use larger units and make them easier to operate. Probably the best example of smoothly-operating crushing plants is the Central Ore Conditioning Plant of Tennessee Coal, Iron and Railroad Co. near Birmingham. (*E. & M. J.* April 1947, p. 74.) This 50,000-ton plant is hooked up electrically so that to start it an operator need push only one button, then stand back.

Grinding

Get two or more millmen together these days and they are almost certain to begin grinding ore. Just as grinding is the biggest single expense in most mills, it is the biggest single topic of discussion in most millmen's meetings.

Nevertheless, there is still a great lack of fundamental knowledge of what goes on in a ball mill, what the pulp density actually is on the inside, how and why the balls wear, what size and how many balls to use for a given feed. Garms, of Hayden; Banks, of Consolidated; Duggan, of Climax; Rose, of Tennessee Coal & Iron; and Myers, of Tennessee Copper have contributed greatly to the beginnings of practical answers to such questions, and much of the following discussion is based on work they have done this past year.

One should first of all make special mention of Fred C. Bond's endless and untiring work at Allis-Chalmers on grindability. His development of grinding indices has proven of value for correlation of grinding data within a single plant. For example, Climax now compares grindability of composite samples with a standard ore to see how closely tonnage actually ground approached what it should have been. But not even Bond's compilations can yet make it possible to forecast accurately how much of what kind of equipment will do the optimum grinding job on your ore.

One of the hottest topics in milling is preparation of feed for the ball mill. For mills under about 600 tons a day, there isn't much choice, because the tonnage is usually too small to stand much capital expense for extra crushers, rolls, or rod mills. For the larger mills, the choice seems clear, even if the reasons for making it are not. It is simply rolls or rods.

One school of thought holds that best results are obtained by putting crushed ore through rolls, if a third stage of crushing is wanted, and then sending it to the ball mill. Feed to ball mills in this method may be fairly coarse, and ball charges must be rationed for maximum capacity. Most tests of this type of operation have indicated that grate mills had higher capacity than overflow mills, although unit grinding costs did not always decrease as a result of the change.

The other school holds that rod mills can do a better job of fine crushing than rolls. The object here is to turn out economically a very fine feed for the ball mill. Such a feed permits using small balls (1-in. balls seem to be about as small as can profitably be used), and grinding efficiency is said to be high. Ball rationing is, of course, not possible or necessary in such a mill.

Last year Anaconda and Yellow Pine both gave the second of the foregoing methods a try by putting in rod mills as fine crushers ahead of their ball mills. For a time it looked as though the choice had been an unhappy one, but as the year ended, both plants expressed satisfaction with the system. In fact, Anaconda plans to put in more rod mills. At Yellow Pine, the trouble turned out to have been with the liners, which were not suited to the speed of the mill. When lifter bars replaced the ribbed liners, the rod mill did excellently.

An interesting, and typical, bit of discussion at the Denver meeting already mentioned brought out the fact that a roll user and a rod mill user got about the same cost (5½c. per ton) for the same reduction (1 in. down to 8 mesh).

With regard to ball milling, there are so many variables that one must go cautiously in even the simplest of statements. However, work is now in progress in several quarters that will give some firmness to future grinding discussions.

The weight of evidence thus far indicates that to grind the product of a cone-type crusher, set at say ⅜-in. or so, a grate mill at fairly high speed with medium circulating load and rationed ball charge will give maximum capacity. However, Climax has data to show that for maximum efficiency in use of power, a high discharge, low-speed mill is best. The latter mill also is easier on high alloy balls that are very hard but very brittle.

On the other hand, if feed to the ball mill can be brought down to below 10-mesh, high capacity and some savings in cost are possible, using small balls. This has been checked by several operators.

Tennessee Copper will try a noble experiment sometime this year when it will install one huge custom-built Hardinge ball mill to replace three smaller ball mills. The mill will be 11 ft. in diameter and 15 ft. between the centers of its Micarta, water-lubricated bearings. (What ever happened to that bearing system? We heard a lot about it 10 or 15 years ago.) It will be an overflow-type mill, using 1-in. balls, and will operate in closed circuit with two Dorr FX classifiers.

Consolidated Mining & Smelting Co. of Canada should have a rod mill turning over by next May that is the big brother of Tennessee Copper's ball mill. Also built by Hardinge, it will be about the biggest rod mill in mining, and it will be used for fine crushing.

Grinding Media

Forged steel balls probably have an edge over cast balls right now, the price of scrap being what it is. Also, forged alloy balls have been somewhat improved in hardness of late, and the price of them has not risen as much as one might expect. One other item to consider these days is that buying a ready-made ball eliminates the man-hours it takes to make a home-made one.

The International Nickel Co. has developed a cast white iron grinding ball of a martensitic nickel-chrome alloy. In grinding tests at a Western concentrator this ball is reported to be doing better than forged steel balls, although it will be quite some time before the results are all in.

Metal carbides are being tested as grinding media by one manufacturer, but data are not yet ready for release. Unquestionably the ultra-hardness of carbide grinding balls would be useful, but their brittleness might prove a handicap.

Flotation

Design of flotation machines is at last beginning to be looked at critically by the men who use them. For years many millmen have held the view that flotation machine design was relatively unimportant in an otherwise correctly handled operation. This is probably true as far as grade of concentrate goes, but of late years there have been several impartial competitive tests of flotation machines in which design was the only thing different among the several machines run-

ning in parallel. Striking differences in rate of power used and recovery of metal showed up clearly, and design is the only thing that could be blamed for them.

Probably to get the best possible results on any one ore, a flotation machine would have to be designed for that ore alone. This is, of course, impossible, except for the largest mills, yet it should be possible to design various machines that would suit broad categories of operation. For example, a non-sulphide float with fatty acid and a low ratio of concentration will call for a different sort of machine than will a scavenger float on a low grade copper ore. A delicate separation between lead and copper would call for still a third kind. However, it should be possible to fit nearly all operations into four or five machine types, and one could then come a lot closer to having the right machine for the job than he does now.

But, as was noted under grinding, there is a tremendous lack of knowledge of what goes on inside a flotation machine. Out in the mills several operators are trying to learn more about these things. F. W. McQuiston reported on some testwork of that kind at the A.I.M.E. meeting in Denver last September. To summarize his results, he found that copper recovery in the Idarado mill (Ouray, Colo.) could be increased substantially by speeding up impellers from 1,600 ft. per min. to 1,900 ft. per min. (peripheral speed). However, greatly increased impeller wear at the higher speed made the change uneconomic.

Rotor-stator machines were tested in the same way, and at 2,150 ft. per min. gave the higher recoveries without the prohibitive wear, providing rubber rotors and stators were used. His conclusion was that rotor-stator machines, run at extra-high speeds, would be used for all rougher circuits at Idarado; impeller-type machines, at normal speeds, would be used for all cleaner circuits. They handled this work very well and had the special advantage for cleaner circuits of being able to circulate froth or pulp among any of the cells without pumps.

Although this conclusion supports the idea that each type of machine has one job it can do best, it also points up the lack of fundamental knowledge in machine design. McQuiston merely took what was available and found out what it could do best for him. None of the machines he used was designed with any one flotation function in mind. That is, if one machine turned out to be a better rougher or cleaner than another, it was not because its designers had planned it that way. It just happened. Why not give the thing some study and plan machines deliberately to do definite jobs?

Flotation Briefs

Although there is nothing to report on oxide or silicate copper flotation, one mill, Mammoth-St. Anthony, has had good luck last year with a new oxidized lead circuit. Cyanamid reagent 425 and stage addition of sodium sulphide do the trick. The plant will be described in an article in an early issue of *E. & M. J.*

Another Cyanamid reagent, No. 404, (how do they keep track of them all?) turned out last year to be exactly what was needed for an oxidized lead float at a mine over in North Africa in which Newmont has an interest. This reagent was developed 20 years ago by Stuart Falconer out at Tintic, and has been waiting around ever since for someone else to use it. On an 8% lead feed that is badly oxidized, the reagent makes a 0.2% lead tail.

Lionel Booth has developed a new flotation machine (U. S. Patent 2433592) that provides rapid pulp circulation from an agitation zone to an upper aeration zone. The latter virtually dips into the former, yet neither zone interferes with the working of the other. Deslimed pulps as coarse as 10-mesh are said to be handled easily, and deeper froth columns than have heretofore been practicable are said to be maintained.

A brief but bitter taste of the future was given one large copper mill recently when it was forced by certain circumstances to treat ore carrying only 6 lb. of copper to the ton. To accept such a feed as a regular diet would demand some revolutionary changes in technique in order to stay in business.

The Coronado mill at Johnson Camp, Arizona, was rated last year by a millman who visited it as having "the most efficient copper-zinc separation work in Arizona." Unusually close reagent control produces the unusually good results.

Banks and associates at Chapman Camp have evolved a gleaner flotation step, which is a strictly C.M.&S. expression meaning "more cleaners." To cut middlings return, two rougher machines were cut out and added to cleaner capacity. The "gleaner" tails go back to the secondary classifiers.

The new Noralyn phosphate flotation plant is scheduled to open soon. This Florida operation of International Minerals & Chemical Co. will be of unusual interest because of the high degree of development of its control methods. To a remarkable extent, it will be a "push-button" job, and it appears likely that it will be the first mill in history to enjoy a continuous, up-to-the-minute record of product assay value.

Gravity Concentration

All of a sudden, there seem to be more new ideas on gravity concentration than you can shake a stick at. Here, in no particular order, are a few of the more outstanding ones.

The Bird centrifuge is being tested at two mills up in Canada to de-slime flotation feed. The Bird people also announced the construction of a new laboratory in which one of the first jobs will be to check on promising new uses of the centrifuge in milling.

Heavy Media Separation, says the Cyanamid Co., is extending downward little by little toward the upper limits of flotation. Refinements of control and a modified flowsheet enable the process to treat material as fine as 28 mesh or so. Several new plants using sink and float processes will go in this year, the biggest of them probably being the Sink-Float plant of Consolidated M. & S. Co. of Canada. A smaller plant will be installed underground at Highland Surprise mine, Pine Creek, Idaho.

American Zinc Company's Heavy-Media plant at Mascot, Tenn., has been highly successful these past ten years, and recent developments there are quite interesting. Using a 9-ft. cone and galena medium, the plant treats a lead-free zinc ore, crushed to minus-2-in., plus ⅜-in., at an average rate of 100 tons per hour.

In 1947, feed averaged 2.29% zinc, the concentrate ran 12.08% zinc, the tailings ran 0.31% zinc. Ratio of concentration in the cone was 5.94:1 and recovery was 88.9%. Cone tailings, which are sold for railway ballast, made up 54.3% of the tonnage sent to the mill.

Just recently, Bristol recording and control equipment has been adopted to handle pH and specific gravity control, and vibrating feeders are used to add galena and trisodium phosphate to the cone. These feeders ultimately will be

controlled by the Bristol instruments, when sufficient experience with them has been gained to permit going to completely automatic control.

United Mining & Milling Corporation, Socorro, N. M., is recovering manganese in an interesting version of the old Hancock-type jig. Hutch product ranges in size from ½-in. on down.

American Cyanamid announced last year that it has obtained the rights to handle the Dutch State Mines cyclone separator for fine-sized material. Possessing unmatched compactness, the cyclone is nothing but a small cone into which pulp is pumped at high pressure. The whirl given the pulp either thickens it or separates its constituent minerals, depending on the conditions set up. For details, see *E. & M. J.* December 1947, p. 74.

Humphreys spirals are doing well. Climax is setting up 128 spirals to recover hübnerite ($MnWO_4$) from the mill tailing. Classifiers make a 150-mesh split on the tailing, sands go to the spirals, pyrite is floated from the spiral concentrate, float tailing goes to a Wilfley table. Classifier slimes go to Denver-Buckman tilting tables. Table concentrate has been going to Colorado School of Mines for further treatment.

John Hamm in Leadville is using 18 spirals to recover oxidized lead from old dumps. An enlargement of International Minerals & Chemical Corporation's phosphate plant at Achan, Fla., took 108 spirals last December. Their new Noralyn plant will use 72 spirals.

The newest thing in tabling was the development last year by U. S. James, Jr., of a method of controlling the sharpness of the kick given a shaking table by its head motion. In several plants it has given cleaner separation than former equipment because of this extra, and apparently very important, control feature.

For additional notes on gravity separation, see the article on iron-ore beneficiation in this issue beginning on page 110.

Little of Everything

Noranda is reported to be planning a plant to recover **sulphur** from pyrite with a high-grade magnetite concentrate as a by-product. Ultimate capacity of the plant might be 200,000 tons of sulphur a year with 600,000 tons of iron oxide. Gold and copper would also be recovered. The development may add years to the life of the mine.

Standard Cyaniding Co., Lovelock, Nev., has a speedy way of emptying **cyanide sand leaching** tanks. It uses only half a ton of water per ton of solids moved. A chronic water shortage mothered the invention. Mill heads at this amazing operation were for a time as low as $1.65, but were expected to climb to $3.00 as soon as stripping had been completed. (See *E. & M. J.*, August 1945, p. 84.)

Out at Combined Metals, Pioche, Nev., **C. M. Marquardt,** who was quoted earlier on an electronic pulp density gage, reports development of an electronic shaft rotation indicator. If a slowly rotating shaft, on a conveyor scale, for example, were to stop because of mechanical failure, the device signals the nearest operator. The indicator could also be set to give warning if the speed of the shaft went above or below a certain desired range.

People, including *E. & M. J.*, keep bringing up **supersonics.** As reported previously, tests on shattering rock with supersonic waves have been made, and work continues. E. H. Rose mentioned recently that a laboratory in Boston has a supersonic device that breaks down flotation froth as though by magic. Its capacity is low, however. The object would be to simplify pumping of froth. It is interesting to note that at least one large laboratory devoted exclusively to mineral dressing has purchased a 150-hp. supersonic wave generator "just for luck."

Oxygen now finds itself in the category of reagents open to the use of millmen. The American Iron & Steel Institute reported last year that new plants for making oxygen would be able to supply it for about $7 per ton or about ⅓c. per lb. That's about as cheap a flotation reagent as one can think of, that is, if there is any flotation technique in which oxygen will prove useful. At least it is there for those who want to try it. Leaching presents another possible use for pure oxygen, perhaps in recovering copper.

There are rumors of work being done to get a smooth flow of **thickened pulp** from under a thickener without using a diaphragm pump. Just how it is done, we can't say.

Variable-speed d.c. motors have been hooked up to thickener **diaphragm pumps** to get better control. International Minerals and Chemical uses a Foxboro density control to change pump speed as density changes. International also uses a rubber hose discharge kept flowing by a pincers, something like the discharge valve the U.S.B.M. worked out over at Tuscaloosa.

Properly blending crushed ore to get a uniform feed to the fine grinding section is something all millmen would like to be able to do, yet a few regard it as a likely possibility. The automatic Central Ore Conditioning plant at Birmingham does it, but only by a tremendous outlay for bins, conveyors, feeders, and automatic controls.

All a small plant would have to do would be to screen crushed ore into fine and coarse fractions and then feed each fraction separately but simultaneously into the grinding unit. Control would be absolute, and it would end all alibis about having "to draw the bin down" or getting "a change of ore."

Not only that, but if feed to grinding were reasonably uniform, there would be little need for great control effort in the grinding circuit or in the flotation circuit behind it. Many of the automatic control instruments now being developed are required only because the mill feed runs all over the map. Iron out the mill feed, and the need for delicacy of control largely disappears.

The only catch is how to feed moist fine ore from a bin into a ball mill. That should make a good research problem for several people, because it won't be easy to figure out, and yet the industry needs it.

Hope For the Future

I should like to end this discussion first by expressing my thanks to the many men in the industry who contributed the material that went into this article. Never before has work on a review article been so heartening.

Second, I should like to quote a friend of mine who was lucky enough to be at that A.I.M.E. regional meeting in Denver last September. He writes: "Never in any previous meetings have I seen as much interest or as much honest-to-goodness desire to do something concrete about research relative to milling. If that spirit continues to live and grow, we may soon see some real progress in milling." To my mind, there can be no doubt of it whatever.

MAGNETIC-TACONITE BENEFICIATION PLANT now building at Aurora, Minn., on eastern Mesabi Range for Pickands, Mather & Co., as it appeared Dec. 1, 1947.

Iron Ore Beneficiation Shows

Construction of first plant for concentrating taconite is begun on the Mesabi. Production will start in 1948. A full-scale iron-ore industry must be maintained in the United States

FRANCIS X. TARTARON

Division Head, Ore Research Division, Research Development Laboratory
Jones & Laughlin Steel Corp., Negaunee, Michigan

WITH STRENUOUS EFFORTS being made to relieve shortages and stem the tide of inflation, 1947 was a year of intense economic activity. The steel industry operated close to 100% capacity. A billion-dollar expansion program was initiated to increase ingot production 2.5 million tons. About half of the amount was spent in 1947 and the rest is to be expended in 1948. Shipments from the Lake Superior region amounted to 77.9 million tons, a peacetime record. This compares with "normal" shipments of 50 million and shipments during the war years averaging 80 million tons. Depletion of reserves continues at a high rate and concern for the future of the iron ore industry remains unrelieved.

Regardless of estimates, the iron-ore producers are moving ahead decisively to solve the problem of ore supply. As revealed by the installation of numerous research laboratories and the projection of proving plants of commercial size, they are now awaiting verification of the estimates before seeking the answer.

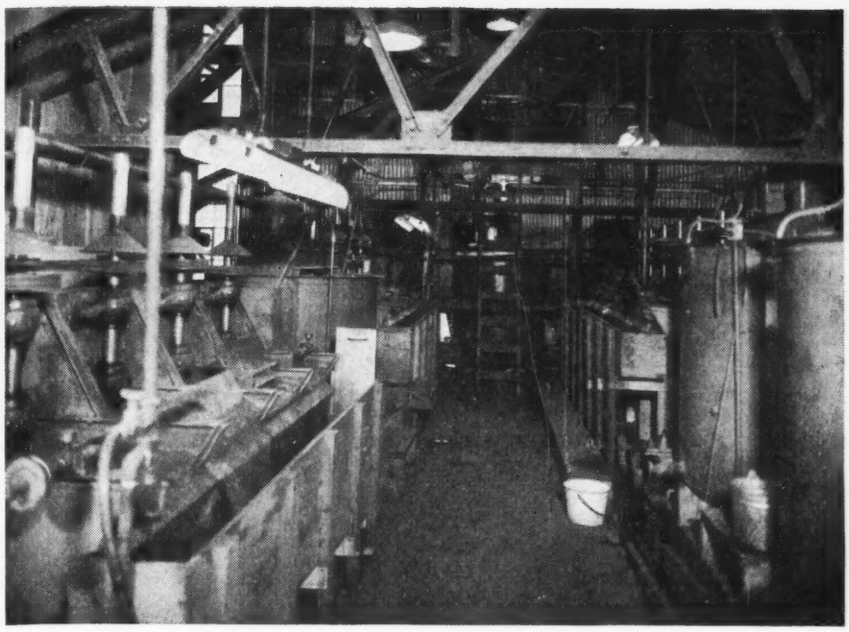
Foreign ores are being studied with a view to their war-emergency possibilities versus their peacetime economics. Consensus is that a full-scale iron-ore industry should be maintained in the United States with foreign ores occupying a minor role.

Reserve Estimates Unchanged

No appreciable change in the appraisal of low-grade ores was made last year. As far back as 1910, four geologists, Van Hise, Leith, Hayes and Kemp, estimated that there was approximately 72 billion tons of iron formation in the Lake Superior district, containing 40% iron and minable to a reasonable depth. Currently, the figure of 60 billion tons is given for Minnesota, running 30% iron. However, Dr. J. W. Gruner calls attention to the presence of complex iron silicates which might interfere in beneficiation. Michigan low-grade ores are thought to run 40% iron.

For beneficiating the low-grade ores, the industry has excellent technological experience to draw upon. Beneficiation includes the three steps of mineral liberation, concentration and agglomeration. Liberation is readily effected by grinding. For concentration there are available: (1) the magnetic separation process for ores containing magnetite predominantly; (2) the flotation process where non-magnetizable iron minerals predominate; (3) conversion of the non-magnetic iron minerals to magnetic form, followed by magnetic separation. For agglomeration, the Minnesota pelletizing process is now reaching the stage of full-scale production. Thus, technologically, the iron-ore industry is not facing a void.

But to change from using high-grade ores to utilizing the low-grade materials will be a stupendous task. The scale of mining will have to be stepped up because 3 tons of ore will be required to produce 1 ton of concentrate. For a



FLOTATION SECTION of Minerals Separation pilot plant on western Mesabi. Quartz is floated from minus-100-mesh feed without desliming.

Healthy Growth

50-million-ton annual production, something like 150 million tons of water will have to be pumped each year. Tailings basins will have to be provided for 100 million tons of fine solids annually. At a plant cost of ten to fifteen dollars per annual ton of concentrate, a total expenditure of over 1 billion dollars will be necessary for mines, plants, railroads and miscellaneous adjustments. Since this is solely for the purpose of changeover, it is a direct charge against the present and future profits of the ore industry.

The Low-Grade Ores

The low-grade iron ores can be divided into two broad classes according to the liberation size of the constituent minerals, that is, the size at which they exist free of attachment to one another. In general, the vast tonnages of iron formation in Minnesota and Michigan will require grinding to 100 mesh or finer to effect liberation. These might well be designated as "taconite-type" ores. The second class includes those ores where free mineral is present preponderantly in much coarser sizes. In Minnesota, they are called "intermediate" ores. However, since such ores occur in other regions, they may be called "intermediate-type" ores. They can be subdivided into magnetic and non-magnetic or mixed. The designation "magnetic" means that the ore contains sufficient magnetite to warrant treatment for recovery of that mineral alone.

"Liberation size" has vital significance in the methods of processing and cost of treatment. The taconite-type ores require high-cost operations, including grinding, flotation or reduction-magnetic separation, and agglomeration. The magnetic taconite-types are favored by the existence of the cheap magnetic separation process. Erection of two proving plants in Minnesota indicates that this type is coming into the range of economic treatment. The taconite-type ores compose the 60 billion tons already mentioned. About five billion tons of this is of the magnetic type, occurring on the eastern end of the Mesabi Range. Considerable quantities of somewhat higher grade exist in Michigan.

The "intermediate-type" ores, containing free minerals at relatively coarse sizes, can be more or less readily processed by existing economic methods, and many plants are in operation. Gravity concentration and magnetic separation are practiced, the former being typical of the Minnesota and Alabama fields, whereas the latter is the principal process in New York and Pennsylvania. Most of the concentrates derived from intermediate-type ores are sintered. In Minnesota, reserves of intermediate-type crude ore are estimated at 156 million tons, with the possibility of another 150 million being added. Northeastern reserves are not clearly estimated, but may amount to approximately 500 million tons of crude.

In the overall picture of the iron-ore industry, these intermediate-type ores are not important due to the relatively low tonnage available. But in the development of the "know-how" of treatment of low-grade ores, they provide a valuable preparation for handling the taconite-type.

Progress with Taconites

Substantially all the iron-ore producers have by now installed research laboratories adjacent to ore holdings. Each laboratory will work on the specific ores and specific needs of its own organization. But there will be no pigeon-holing of knowledge. The producers are strongly industry-conscious and exchange of information as well as collaboration in projects is constantly practiced. Additions to research facilities in 1947 were: (1) the Jones & Laughlin laboratory in Negaunee, Michigan, which started operation in October; (2) the M. A. Hanna laboratory in Hibbing, now in process of construction; (3) the initiation of a research unit in the southeastern district by the Tennessee Coal, Iron and Railroad Co. to work on iron ore and coal beneficiation, under the direction of E. H. Rose.

Outstanding in events of the year was the start of construction of two proving plants for beneficiating the magnetic taconite on the Mesabi Range. If successful, these plants will mean the addition of some 1.7 billion tons of high-grade to available reserves. Beneficiation of magnetic taconite will provide the transition from direct-shipping to low-grade ores. Hence, the present projects are of great significance.

One of these plants, that of the Pickands, Mather company, near Aurora, Minn., cost 1.5 million dollars and will be in operation July, 1948. It is expected to produce 200,000 tons annually by magnetic separation. Feed will be ground through 100 mesh and ratio of concentration will be 3:1. If successful, production will be expanded. Pickands, Mather is the largest holder of taconite lands, having leased some 50 properties compris-

ing an area totaling 5,000 acres.

Oglebay-Norton is completing construction of a 77-million-dollar plant at Babbitt, Minn., including a 48-mile railroad to Beaver Bay on Lake Superior, as well as dock facilities. The plant will produce by magnetic methods 5 million tons annually of agglomerated concentrate. Construction, it is estimated, will require five years. The project is supported by Cleveland-Cliffs, Wheeling Steel and American Rolling Mill. If successful, two more units will be built.

Tax concessions have been granted by Minnesota for those exploiting taconite ores, a royalty of 6c. a ton of concentrate being specified, as against 43c. on normal shipping ore. This is reported as being the major factor making the magnetic-taconite plants economically possible.

The Oliver Iron Mining Co. has started extensive work on taconite beneficiation. Last year it acquired leases on three taconite units near Aurora, Minn. Jones & Laughlin Steel Corporation has begun work on the Michigan ores.

Projects Under Way

At Kirkenes, Norway, a full-fledged magnetic-taconite plant is being rehabilitated after having been destroyed during World War II. This plant will continue treating an ore that is almost identical with the Mesabi magnetic taconite. Minus 150-mesh concentrate was briquetted without a binder in pressure filters and hardened in a 210-ft. kiln at 2,200 deg. F.

Discussions of comminution indicate that the rod mill has been accepted as most suitable for "fine crushing," from ¾ in. to 20 mesh, with ball mills as finishing grinders. Blaw-Knox is testing its jet pulverizer on Michigan ore. A vertical ball mill and supersonics comminution are on the horizon.

Flotation Successful

Flotation is being proved metallurgically successful, though the problem of cost remains. Minerals Separation and Pickands, Mather operated their pilot plants in 1947 mainly on washer tailings. During August, the former company averaged a concentrate running 56.5% iron, with 9.32% silica and 71.2% recovery. The feed ran 19.42% iron. Recoveries ranged up to 82%. American Cyanamid is continuing laboratory work and the Bureau of Mines in Alabama is very active.

Sloss-Sheffield Steel & Iron Co. has been operating a pilot plant in Alabama for reduction to artificial magnetite and magnetic separation.

The Dorr Co. is perfecting its Fluosolids reducing furnace for possible use on taconite containing non-magnetic iron mineral.

Pickands, Mather & Co. and Oglebay-Norton will employ the Minnesota pelletization method for agglomerating concentrates.

Progress Being Made Also With Intermediate Ores

About 23% of Minnesota shipments represent concentrates, substantially all of the Northeastern (New York, New Jersey and Pennsylvania) production is concentrate, and about 12% of the Southeastern district (Alabama, Virginia and Georgia) output are products of beneficiation. Of the average production in the United States for the years 1942-46, about 15% represents concentrates from the Lake Superior district, 3% from the Northeastern district and 1% from the Southeastern district. Thus the Lake Superior region produces the bulk of the concentrate. However, over 80% of this concentrate is obtained by a simple washing operation. Excluding washing, this district produces somewhat less than the Northeastern district by beneficiation.

The Minnesota intermediate ores present a difficult problem due to the inclusion of unaltered or partly altered taconite as well as "frozen" (attached) silica. The irregularities of the leaching of the original taconite made for the frequent presence of such middling particles throughout the whole range of sizes rather than in the coarser fractions only. Taconite can occur as coarse as boulders and down to the size of mineral liberation 65 to 100 mesh. Recovery of iron from such middlings would require grinding so fine as to remove it from the range of intermediate ore into that of taconite ore. Rejection was the only solution. It was the success of heavy density in doing this that resulted in its displacing jigs. Only one jig plant operated on the Mesabi in 1947 as against seven in 1942. Four heavy-density plants operated as against one in 1939. However, research in jigging is continuing and the Oliver Iron Mining Co. is investigating the Baum jig and Jeffrey high-frequency jig. But heavy density cannot treat material below ⅛ in. in size.

On the fines, a number of devices are being employed, all of which can be described as partially effective and economically feasible. Double-classification operates on the range from ¼ in. to 65-mesh but requires a feed that is 50% iron in grade. The Dorr sizer operates on minus-20-mesh feed preferably, but in rare instances can go up to 4-mesh. Twenty-six machines were in operation in 1947.

Weight recovery of 16% and iron recovery of 38% are reported on washer tails. The Selective-Media concentrator recovers material from ⅜ in. to 48-mesh. Two installations operated in 1947. Differential grinding in rod mills followed by concentration in standard classifiers or in Selective Media concentrators is making progress. Ball mills are also being introduced for differential grinding.

Eastern Methods

In the Northeastern district, magnetic separation predominates. However, the appearance of hematite in magnetic ore is shifting attention to gravity concentration. In the Southeastern district, the brown ores of Alabama are treated by simple washing and screening. The red ores require more elaborate methods, including classification and tabling. Republic Steel's Spaulding plant at Birmingham tables 2,700 tons per day of minus-8-mesh feed. Sintering operation is unusual in that the material sintered contains 40% minus-150-mesh.

The Humphreys spiral, now in the pilot-plant stage, is emerging as a new tool in iron ore beneficiation. At the Jones & Laughlin Benson property, on a mixed magnetite-hematite feed (minus-14 to 20% minus-100-mesh) a recovery of 85% with a grade of 62% is being obtained. Butler Brothers report very satisfactory results on washer tailings in Minnesota. The U. S. Bureau of Mines is running tests on Alabama red ores.

Driessen Cyclone Introduced

The Driessen cyclone, which employs centrifugal force in conjunction with heavy-density separation, is being introduced for possible recovery of fine iron. Range is from 3/16 in. to 100-mesh and finer. The spiral classifier has become established in replacing the cone in heavy-density work. Cleveland-Cliffs is installing two additional 78-in. separating classifiers in Minnesota in a 400-ton-per-hour plant.

The Hardinge fine-ore concentrator has run into difficulties in going from laboratory to commercial-size machines. The Hydrotator is being tested on minus-⅛-in. classifier concentrate that has been subjected to "abrasion grinding" in a ball mill.

Stanley Mining Co. is erecting a heavy-density plant at the Mary Ellen mine, Biwabik, Minn. Sloss-Sheffield has installed a heavy-media plant at Russellville, Ala., treating brown ore to recover limonite. Shook & Fletcher Supply Co., in Alabama, started a new 100-ton-per-day gravity concentrator.

The Oliver company is erecting two iron-ore beneficiating plants at a cost of 2 million dollars. A six-year program calls for four more plants. Inter-State Iron Co. started its new washing plant at the Longyear mine, at Hibbing. M. A. Hanna has constructed a plant near Spring Valley, Minn., to crush, screen and wash ore. Through its subsidiary, the Ozark Mining Co., it is mining, jigging and tabling ore at Iron Mountain, Mo.

Lone Star Steel has started its 3-million-dollar beneficiation plant at Daingerfield, Texas. Sheffield Steel Corporation resumed operation of its plant west of Jacksonville, Texas.

Sintering, Pelletization and Direct Reduction

All iron-ore concentrates ¼ in. and finer must be agglomerated for use in the blast furnace. For the intermediate-type ores, sintering is generally employed. For the taconite-type, the Minnesota pelletization method is now being placed in operation on a plant scale. Sintering of the Lake Superior fines is carried on at the furnaces, whereas the Northeastern and Southeastern fines are sintered at the mines preponderantly. Sintering grows more difficult as the proportion of minus-100-mesh material increases, and this problem is growing because the trend is toward finer recoveries on the intermediate ores. Pelletization operates on very fine material only, 50% or more of minus-325-mesh being required.

A joint project to test the Minnesota pelletization method on a large scale, involving the expenditure of one million dollars, is now in progress, with American Rolling Mill, Wheeling Steel, Cleveland-Cliffs, Reserve Mining and others collaborating. Preparation of pellets and blast-furnace trials are contemplated.

In sintering, a swinging burner to replace the usual fixed type has been found to effect a 40% saving in fuel. Bethlehem Steel installed a new sintering unit at Johnstown, Pa. The Algoma sintering plant on the Michipicoten Range treats plus-8-mesh minus-5/16-in. iron carbonate. A fourth unit is being added, boosting sinter production to 3,000 tons per day. The M. A. Hanna sinter plant on the Cuyuna operated steadily. These are the only two sinter plants located at the mines in the Lake Superior district.

The Bureau of Mines has rejected the bubble hearth reduction furnace for producing sponge iron. Particles could not be maintained in suspension after reduction due to increase in specific gravity. Their method permits the use of cement brick plants or cement kilns, utilizing non-coking coal or lignite. The product is claimed to be highly desirable in replacing scrap for the production of tool and cutlery steels in the basic electric furnace.

Iron Powder Plants

Three iron powder plants are reported in operation. At Tacoma, Wash., the Tacoma Powdered Metals Co. is producing 10 tons per day. Scrap iron is dissolved and iron powder produced electrolytically. At Aurora, Minn., the plant sponsored by the Resources and Rehabilitation Commission started treating 50 tons of iron carbonate (30% iron) per day with expected production of 5 tons of powder. The carbonate is dissolved, ferrous sulphate is precipitated, dried, roasted and reduced. The product is minus-100-mesh, running 99% pure. Plant cost is over one million dollars. The Buell Metals Co. at Painesville, Ohio, is operating a process developed by Butler Brothers at Cooley, Minn. Ferric chloride is employed as electrolyte with ingot iron plate as anodes and stainless steel as cathodes. The brittle cathode deposit is removed and ground to powder in a Hardinge mill. Production is 5 tons per day.

Significantly none of the preceding plants uses iron-oxide ore as raw material. This is no doubt due to the fact that few ores run sufficiently high-grade. However, high-grade portions of present deposits, or portions that can be made high-grade by beneficiation, may have a good market for iron powder manufacture.

The Allis-Chalmers group continued work on grindability indexing of all varieties of ores. A wealth of data is being obtained and relationships are being developed, as between grindability and mill-power consumption. In rod milling, the tumbling of the rods is promoted (lubricated) by the presence of slimes. Removal of slimes caused stoppage of tumbling. Flotation research continued along the lines of investigations of specific chemical reactions but the basic theories of "adsorption" vs. "chemical action" have not yet been reconciled. Armour & Co. has established a fund of $12,000 at M. I. T. for fundamental flotation research specifically for cationic reagents. Negligible work is revealed on the fundamentals of sintering, pelletization or direct reduction.

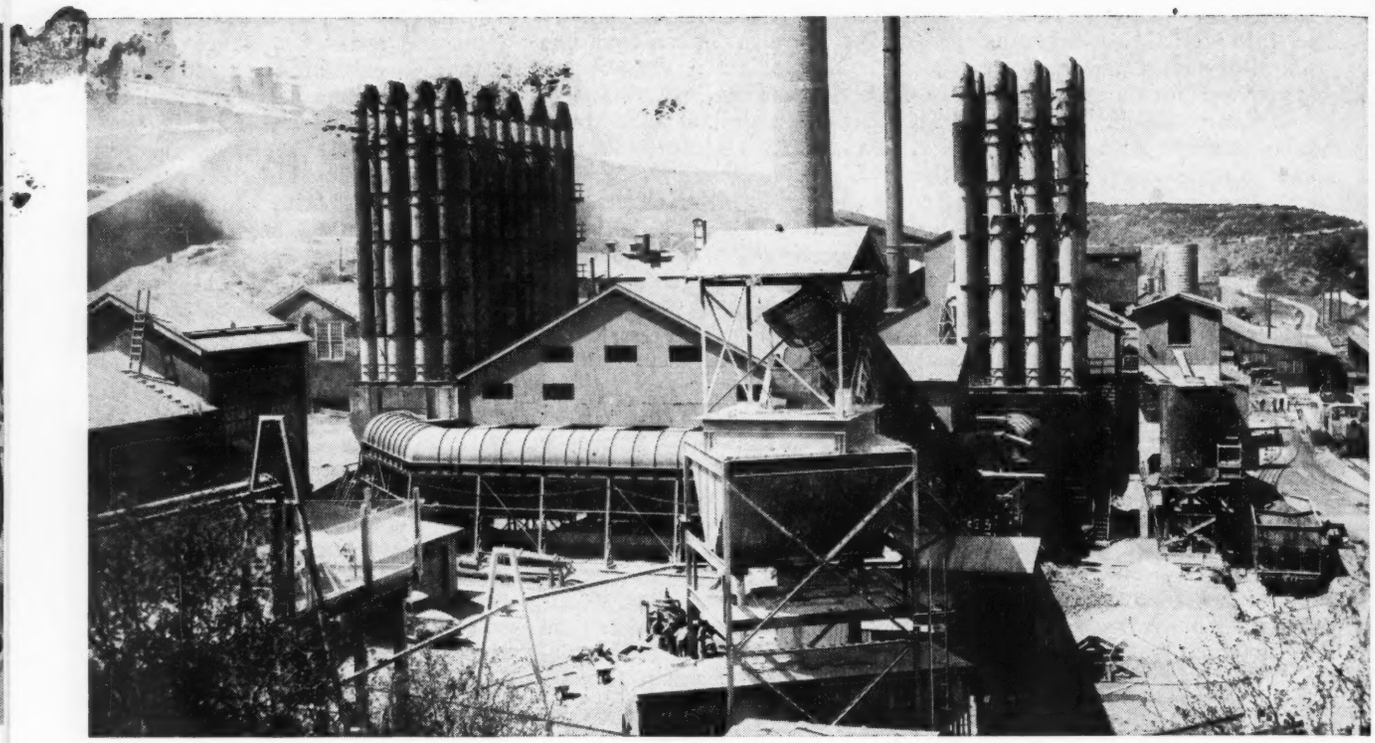
Dissatisfaction with the present methods of iron ore beneficiation research was voiced by Walter Maxson at the Duluth Mining Symposium in January, 1947. He called for increased application of fundamentals. In the September issue of *Mining & Metallurgy*, Prof. A. F. Taggart expressed equal dissatisfaction with the fundamentals themselves. He said: "When all is said and done, however, the fact remains that no sound quantitative expression has yet been offered for one single movement of either particle or fluid in any gravity concentration operation."

Empirical Methods Accounted for Progress

Practical research engineers hew their own fundamentals from direct observation of the behavior of materials in apparatus and machines. From these, adjustments and new combinations are made, leading to useful results. This method can aptly be termed "behavior." It was "behavior" that produced the flotation process. There was no theory. It is "behavior" that is developing the gravity processes in Minnesota, which incidentally are no mere copies of the old processes employed in the non-ferrous industries, but are brand new and specifically adapted to a highly complex problem. Whatever science there is in mineral dressing was derived from "behavior." We should be more appreciative of this intellectual tool, study it and learn how to use it more effectively.

Acknowledgment

Grateful acknowledgment is made to the many engineers who kindly contributed information for this article.



A SLAG-FUMING PLANT, like this one at Kellogg, is being built at El Paso smelter. Furnaces will hold 60 tons of lead slag.

Non-Ferrous Metallurgists

Plant modernization and development of new processes for roasting and refining help to combat rising costs and to meet continued strong demands for metals. Low-cost oxygen holds great promise for metallurgists in all fields.

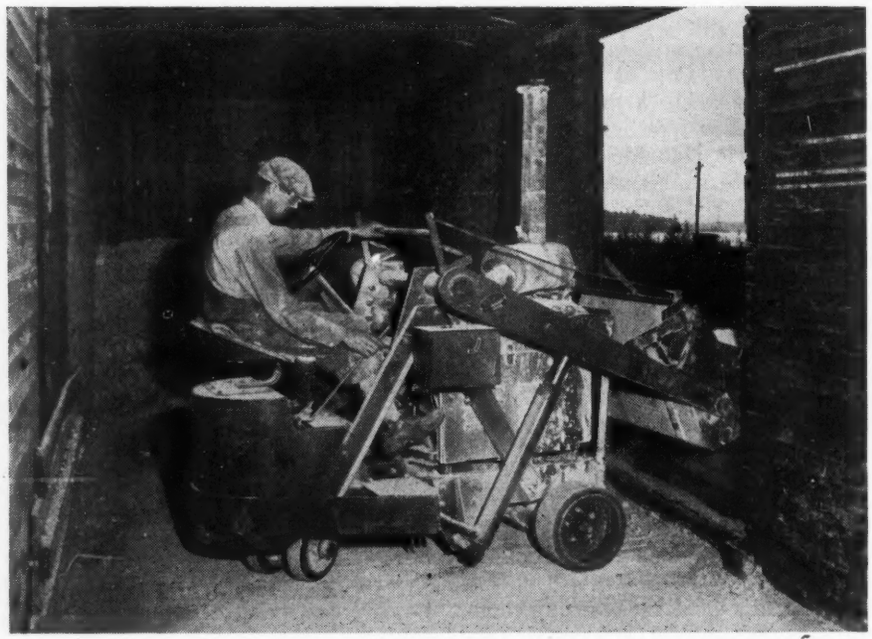
CARLE R. HAYWARD
Cambridge, Mass.

THE METALLURGICAL INDUSTRY has shaken off the results of abnormal wartime operation and is devoting itself to the problems of peace. It is at once apparent that these new problems are both different and perhaps more formidable than those of the decade before the war.

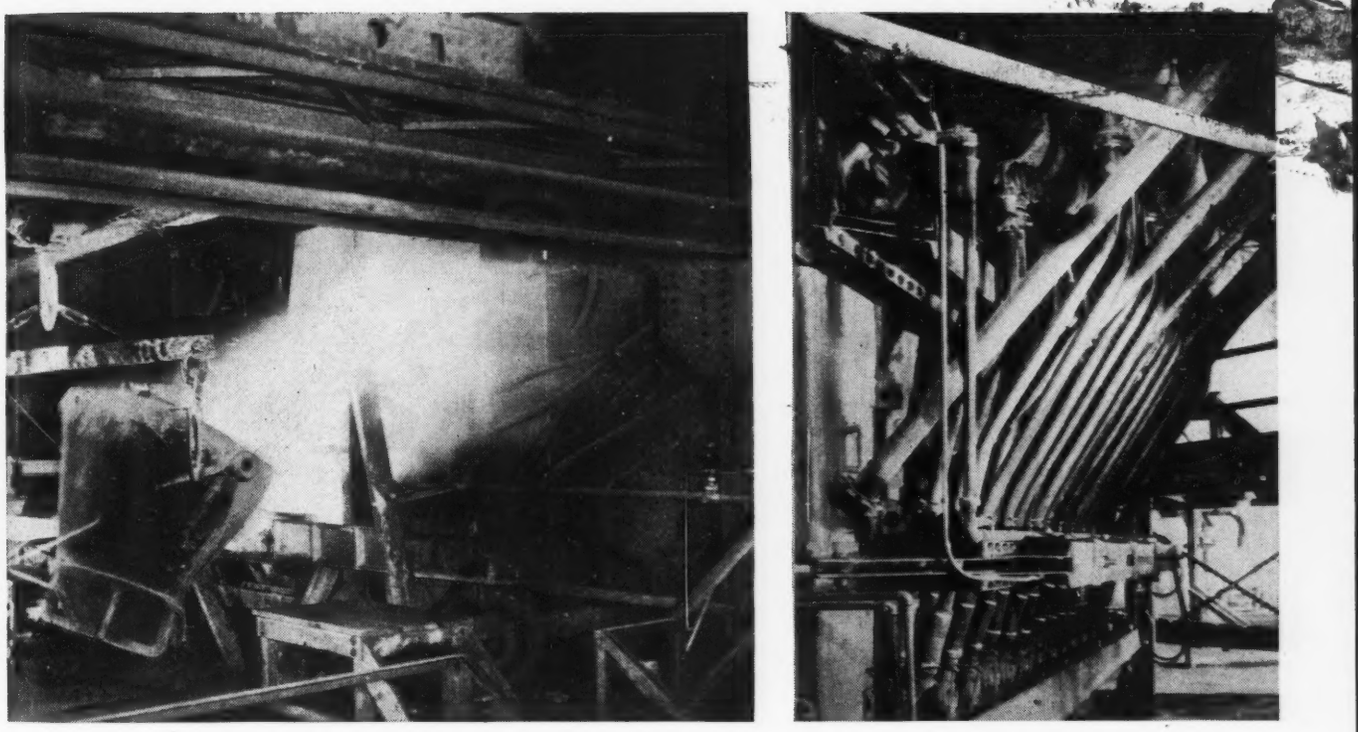
Although demand for metals is high, no one can safely predict the duration of present conditions, and it is difficult to decide how far to go in new smelter construction or renovation. Steadily rising construction and operating costs add to the problem.

Local conditions greatly influence decisions in multi-plant organizations, as at Leadville, Colo., where American Smelting & Refining Co. is extensively renovating its old lead smelter in preference to spreading a similar appropriation over its several other lead plants.

One of the inescapable costs in smelting is fuel. To use it more economically, plants are continually improving burner equipment, and several are now extensively altering waste heat boilers to get better power conversion.



CHIHUAHUA smelter has dropped hand methods, uses machines like this Carscoop.



CHARGING the zinc-fuming furnace at Kellogg. Tuyeres, coal, water piping are seen at right. El Paso's furnace is about twice as big.

Report New Processes

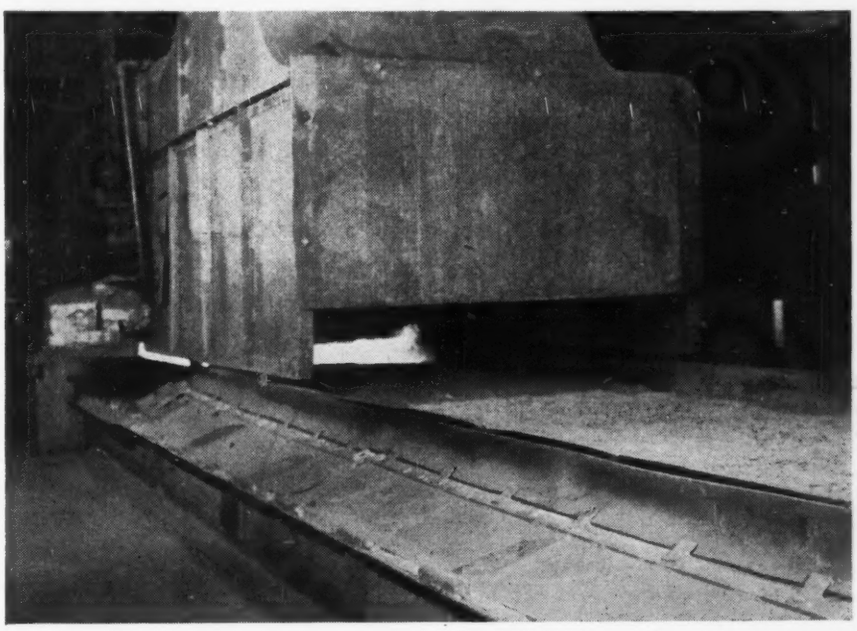
This becomes particularly important where raw moist feed is used in copper reverberatory furnaces. The extra fuel required by such a charge produces excessive amounts of gases with danger of low total heat recovery. An efficient boiler system minimizes this objection.

A good example of waste-heat boiler improvement was recently completed at the Garfield smelter. Here two conventional Foster Wheeler boilers have been installed, but each has a cooling chamber through which the hot furnace gases must pass from the furnace uptake. The walls of these chambers are lined with vertical 3¼-in. O. D. steel tubes on 10-in. centers through which water is circulated. The purpose of the chambers is to chill and solidify any fused particles in the gas stream to prevent their sticking to the boiler tubes. The boilers work more efficiently and are easier to clean. Vulcan mechanical soot blowers do the cleaning in the boilers; the walls of the cooling chamber are cleaned by special equipment.

Material cleaned from boilers and cooling chambers is caught in hoppers which discharge to mechanical conveyors leading to the furnace charge hoppers. Dust that passes through the boilers is caught in Polyclone dust catchers that discharge to the same conveyors serving the boilers.

The equipment reduces the temperature of the gases from 2,330 deg.F. to 710 deg.F. The steam produced by the two boilers averages an output of 42,000 lb. per hour.

Another item of progress particularly applicable to raw feeding is the preheating of combustion air, which has usually been done by waste heat. It has been found that where raw moist feed is used in reverberatory smelting, it pays to use primary fuel for preheating the



TENNESSEE COPPER sinters minus 65-mesh flotation concentrate by special technique.

air. It is obvious that this will increase the smelting rate and give an additional control on furnace temperatures.

It might be argued that primary fuel might better be used to roast and preheat the charge, but there are obvious advantages in raw feeding. If preheating the air will give furnace capacities equivalent to, or better than, those obtained when hot roasted feed is used, the practice merits attention.

Slag-Fuming Spreads

The latest installation of a slag-fuming plant is at the El Paso smelter, where one is now being built similar to the furnaces operating at Trail, B.C.; East Helena, Mont.; Kellogg, Idaho; and Tooele, Utah. Like most old lead plants, the El Paso smelter has a slag dump containing a large total tonnage of lead and zinc.

The El Paso furnace is to be 22 ft. long, 22 ft. high, and 8 ft. wide, with 42 tuyeres located 2 ft. below the charge level on each side of the furnace. The furnace is designed to hold 60 tons of slag, and the treatment time will be 100 to 150 minutes. Pulverized coal, 90% minus-200-mesh, will be blown through the submerged tuyeres under 14 lb. air pressure. The coal will be prepared by unit pulverizers, and no storage for pulverized coal is required.

Zinc fumes rising from the charge are to be burned in the upper part of the furnace by adding about 1,500 cu.ft. per minute of air. Effluent gases and fume will pass first through a 20,000-sq. ft. waste-heat boiler, then to a 17,000-sq.ft. economizer followed by 36 four-tube coolers. After dilution with 50,000 cfm. of air, gases will be filtered in a baghouse containing 960 30-ft. bags arranged in six compartments, and then delivered to a 300-ft. stack. Baghouse capacity is designed to handle 150,000 cu.ft. of gases per minute.

Estimated temperatures at the various phases are as follows: 2,100 deg.F. entering the boiler, 700 deg.F. leaving the economizer, 275 deg.F. leaving the coolers.

Fume collected from the boiler, the flues, coolers, and baghouse is combined and treated in two gas-fired rotary kilns, each 7x75 ft., to densify and fume off the lead. Lead fumes are condensed and added to the blast-furnace charge. Zinc oxide is shipped to a retort plant for working up into Prime Western zinc. The plant is expected to produce about 2,000 tons of zinc oxide per month.

Previous reviews have mentioned the successful recovery of SO_2 from Dwight-Lloyd gases at the Selby smelter. A commercial unit having a capacity of 20 tons liquid SO_2 per day was put in operation in October, 1947, and further details will be of interest.

The gases produced by D. and L. machines, equipped with re-circulating systems, contain about 5.5% SO_2. They are cleaned by hot Cottrell, scrubbing towers, mist Cottrell, and coke filter, after which they pass either to the four-year-old contact acid plant or to the new liquid SO_2 plant.

The absorbent used in the liquid SO_2 process is anhydrous dimethylaniline. At atmosphere temperature, this reagent can absorb approximately 15% by weight of SO_2 in an eight-tray tower with an absorption efficiency of 99%. The Selby process has many points of departure from the well-known Hanish-Schroder water absorption process, but details must be omitted here for lack of space.

The SO_2 recovered from the dimethylaniline is cooled, dried by passing through concentrated H_2SO_4, and liquefied. It has uses in oil refining, beet-sugar refining, fruit curing, soil treatment, and refrigeration.

New Blast Furnaces

The shaft furnace for smelting is one of the metallurgist's most ancient devices, but there is still no general agreement on its proper shape and there is uncertainty on methods of operation. J. S. Stewart has applied for patents on a lead blast furnace of unusual design which contains new features based on theory and his experience in practice.

A furnace of equally radical design is under construction at the Chihuahua (Mexico) lead smelter. It is to be 10 ft. wide, 20 ft. long, and will have a double row of tuyeres. The lower row will be stepped-in by offset jackets to provide the conventional 5-ft. width above the crucible. The jacket will be vertical, and extend to the charge floor. The end jackets will be curved to give the furnace semi-circular ends.

New slag disposal methods will be used at this plant. Slag will be granulated by well-known methods and handled by bucket elevator to storage silos, which are sufficiently large to hold a day's output of slag. Once each day, a belt conveyor will move slag to the dump. The new procedure eliminates the present slag locomotives, tracks, and pots.

Mechanical unloading and handling of concentrates are now being practiced at Chihuahua with Carscoops, belts, a bridge crane, and grab buckets. The change from hand labor has fully justified itself.

Changes to promote economy and efficiency have been made recently at the Tacoma smelter. Here two new 100-ton per hour crushing units have been installed and the capacity for concentrate storage doubled. Hand labor has been reduced by installing mechanism for dumping sacks of ore.

Tacoma has been an important arsenic producer and its equipment for arsenic has been completely modernized.

This trend toward mechanization is taking place in many plants. The use of mechanical devices for punching converter tuyeres is still in the experimental stage, but the results are encouraging and it should not be long before this much desired improvement becomes usual procedure.

It will be of interest to see what effect, if any, the approaching expiration of the patents on the New Jersey Zinc Company's vertical retorts will have on the zinc industry. In these days of high wages, the large number of men required in a plant using Belgian retorts is no inconsiderable item of cost. It would certainly be in accordance with the trend of the times if this should spell the doom of the small retorts.

It is reported that the Langeloth zinc plant, which has had a long and honorable history, has been closed and dismantled. Perhaps this is a straw in the wind.

New Nickel Process

One of the most fascinating metallurgical developments which has appeared for many years is the new process recently patented by W. K. Sproule and G. A. Harcourt, of the International Nickel Co. (U.S. Patents 2,419,973 and 2,425,760), for the separation of copper and nickel sulphides occurring in matte, and the recovery of precious metals contained in the matte.

The heart of the process is the fact that if the matte is cooled very slowly through the solidification and transformation range, the product will contain independent crystals of copper sulphide and

nickel sulphide, which can be separated by crushing and concentration.

There is no information on the operations beyond that revealed in the patents, but these indicate the following steps:

1. Treat the reverberatory matte in the usual way in a converter until the iron sulphide is eliminated.

2. Pour the molten copper-nickel matte into pots and cool slowly under controlled conditions from the beginning of freezing to below 950 deg. F. (510 deg. C.).

3. Cool slowly or rapidly to a point below 200 deg. F.

4. Crush and grind to free the copper-sulphide crystals from the nickel-sulphide crystals.

5. Separate the two sulphides by mineral-dressing methods.

The first step has been standard procedure for many years and requires no comment.

The crux of the process is in step two. It is obvious that the patents cannot be too specific regarding temperatures because the beginning of freezing will vary with matte composition. In general, the copper sulphide will begin to solidify first, and slow cooling will promote the growth of crystals by accretions of solidifying Cu_2S on the original nuclei. The nickel sulphide, which is probably Ni_3S_2, exists in two forms designated as alpha and beta. The latter is the stable form in the lower temperature ranges and has little solubility for copper sulphide. If the cooling is carried out properly, the final mass consists of crystals of Cu_2S and Ni_3S_2, each containing only small amounts of the other, and of sufficient size to allow for mechanical separation.

The patent gives a wide range in the rate of cooling with limits of one to fifteen days. These limits are probably thus stated to protect the patent, and it is fair to assume that the optimum time is in the lower ranges between these limits.

Step three calls for continued slow cooling after solidification. This is to allow for completion of the Ni_3S_2 transformation and a solid state diffusion of the Cu_2S to join the crystals already formed. There is no indication in the patents as to how the cooling is controlled or whether the rates are varied at any stages.

Although not stated, it is probable that step four is carried out by conventional methods and that step five is by flotation.

If it is desired to recover gold and platinum, a modification of the process is required, which works on the same principle as the old method of collecting precious metals in metallic "bottoms" separated from matte low in sulphur.

In this case the sulphur is first reduced to a point slightly under that required to produce Cu_2S and Ni_3S_2 from the copper and nickel present. The mass is then cooled slowly as previously described, when in addition to the finely divided crystals of Cu_2S and FeS, some fine crystals of a copper-nickel alloy are formed. These contain a major portion of the gold and platinum. This alloy is magnetic and after the mass is crushed and ground, it may be separated from the sulphides by wet magnetic concentration.

A metal further enriched in precious metals may be obtained by re-fusing the first alloy crystals with some sulphur or low-grade matte to sulphidize a portion of the copper and nickel and leave a smaller amount of metal containing a major portion of the precious metals.

The patents summarized above have specific application to the nickel industry in the Sudbury district, but they are intriguing in their use of fundamental science. Some of our ore deposits containing finely divided mixed sulphides were probably formed in the same way, and here a practical application of nature's own laws is being made to separate sulphides produced in a smelting operation.

The new process has as yet not gone beyond the experimental stage, but its commercial development is now being prepared for and the company is confident of its success.

The production of nickel sulphide, low in copper, will open the way to a more extensive use of sintered nickel oxide in the steel industry as a cheaper substitute for metallic nickel.

Continuous Casting

Continuous casting methods have been studied experimentally for many years and in some cases used commercially for relatively small production. The American Smelting and Refining Co. is operating a new plant for continuous casting of certain copper-base alloys into rods, tubes, and regular shapes. Currently, the castings are produced in diameters from $\frac{1}{16}$ in. to $4\frac{7}{16}$ in., and longer sizes are in prospect.

The continuously-cast products are characterized by high current density and fine dispersion of secondary phases, such as lead. Straight lengths, up to 20 ft., suitable for automatic screw machines, are available, and coils can be furnished for diameters under $1\frac{1}{2}$ in.

Because of their inherent properties, the products are being used in place of sand, permanent mold, and centrifugal castings in alloys containing tin, lead, nickel, and zinc.

Cheap Oxygen

The rapidly growing interest in the use of oxygen and oxygen-enriched air for metallurgical purposes is very gratifying. The A. I. M. E. held a symposium on this subject in 1924, which clearly pointed out some of the advantages of metallurgical use of oxygen. Yet there were skeptics who rejected the whole suggestion, and even some who, although they recognized the importance of the subject, felt that production of cheap oxygen was merely a dream.

Some experiments with the use of oxygenated air in direct smelting of copper concentrates in a converter were made a few years ago in the M. I. T. laboratories by E. R. Marble, Jr., under my direction. A representative of the company that cooperated by furnishing the oxygen ridiculed the idea that oxygen could be produced cheaply enough to make it attractive commercially.

The following quotation from a statement of mine in 1937 is pertinent today ("Mineral Industry," Vol. 40, p. 96):

"Perhaps it is time to look away from standardized procedure, efficient though it may be, and see if a radical change can produce something even more efficient. A contributing factor in this respect may be the use of oxygen-enriched air. This has lain surprisingly dormant since the A. I. M. E. symposium on the subject in 1924. Recently, however, the results of several investigations in Europe clearly indicate that oxygen can be produced at a moderately cheap rate, which may have economic and metallurgical advantages."

The day of cheap oxygen has arrived, and metallurgists are caught flatfooted. We hear of belated experiments in iron and steel operations, but little or nothing in the non-ferrous field. It is high time that every phase of pyrometallurgical operation be studied in the light of present and prospective oxygen costs. This reagent is too important to industry to be ignored any longer.

MARKETS — Trends and Prices

DEMAND FOR MAJOR NON-FERROUS metals continued at a high rate throughout January. Consumers absorbed about all of the copper, lead, and zinc that was offered to them. The E. & M. J. index of non-ferrous metal prices advanced from 152.48 in December to 154.20 in January, reflecting higher monthly averages for tin and zinc.

Outstanding in price developments was the rise in Prime Western zinc on Jan. 21 to the basis of 12c. per pound, East St. Louis. The former quotation of 10½c. was established as far back as Nov. 12, 1946. The spark that set off the price change was an announcement by Eagle-Picher Mining & Smelting on Jan. 20 that it raised its settlement basis for Tri-State zinc concentrate $6 per ton, establishing the market for ore in that area at $78. Though some important slab zinc producers did not favor the extent of the rise, no serious opposition to the 12c. quotation developed. With stocks greatly reduced, those smelters who objected to the move lacked the "ammunition" to check the rise. Demand for Prime Western zinc from galvanizers continued active even after the higher price became effective. As the month ended the undertone of the zinc market was quite firm. In the export field, prices paid for Prime Western zinc in the last week of January varied between 12c. and 12¼c., f.a.s. Gulf ports, indicating that foreign buyers were eager to acquire the metal.

Copper in the domestic market was purchased freely for February shipment, with the wire and cable industry particularly active. The quotation continued firm at 21½c., Valley. Fabricators consumed 110,142 tons of copper in December, which total was only moderately below the monthly average for 1947. Sales of copper in the foreign market improved somewhat and our average price for January was a little higher than a month ago.

Lead continued in an extremely tight position, with some sales of foreign lead at premium prices. Higher prices were paid for scrap. Producers contend that a higher price than 15c., New York, at this time would hardly remedy the situation.

The recent freight rate adjustment caused the ex-store quotation for antimony to rise moderately.

Quicksilver was in ample supply and the price declined to $77 per flask.

Major Metals

U. S. DAILY AND AVERAGE PRICES

Jan. 1948	Electrolytic Copper: Domestic (a) Refinery	Electrolytic Copper: Export (b) Refinery	Straits Tin: New York	Lead: New York	Lead: St. Louis	Zinc: East St. Louis
1	Holiday	Holiday	Holiday	Holiday	Holiday	Holiday
2	21.200	21.525	94.000	15.000	14.800	10.500
3	No Market	21.425	94.000	15.000	14.800	10.500
5	21.200	21.425	94.000	15.000	14.800	10.500
6	21.200	21.425	94.000	15.000	14.800	10.500
7	21.200	21.575	94.000	15.000	14.800	10.500
8	21.200	21.450	94.000	15.000	14.800	10.500
9	21.200	21.675	94.000	15.000	14.800	10.500
10	No Market	21.675	94.000	15.000	14.800	10.500
12	21.200	21.550	94.000	15.000	14.800	10.500
13	21.200	21.550	94.000	15.000	14.800	10.500
14	21.200	21.550	94.000	15.000	14.800	10.500
15	21.200	21.450	94.000	15.000	14.800	10.500
16	21.200	21.500	94.000	15.000	14.800	10.500
17	No Market	21.525	94.000	15.000	14.800	10.500
19	21.200	21.500	94.000	15.000	14.800	10.500
20	21.200	21.650	94.000	15.000	14.800	10.500
21	21.200	21.425	94.000	15.000	14.800	12.000
22	21.200	21.575	94.000	15.000	14.800	12.000
23	21.200	21.600	94.000	15.000	14.800	12.000
24	No Market	21.550	94.000	15.000	14.800	12.000
26	21.200	21.550	94.000	15.000	14.800	12.000
27	21.200	21.525	94.000	15.000	14.800	12.000
28	21.200	21.500	94.000	15.000	14.800	12.000
29	21.200	21.525	94.000	15.000	14.800	12.000
30	21.200	21.575	94.000	15.000	14.800	12.000
31	No Market	21.550	94.000	15.000	14.800	12.000
AVERAGES FOR MONTH						
Jan.	21.200	21.532	94.000	15.000	14.800	11.077
AVERAGES FOR WEEK						
Jan. 7	21.200	21.475	94.000	15.000	14.800	10.500
14	21.200	21.575	94.000	15.000	14.800	10.500
21	21.200	21.508	94.000	15.000	14.800	10.750
28	21.200	21.550	94.000	15.000	14.800	12.000
CALENDAR WEEK AVERAGES						
Jan. 3	21.200	21.480	94.000	15.000	14.800	10.500
10	21.200	21.538	94.000	15.000	14.800	10.500
17	21.200	21.521	94.000	15.000	14.800	10.500
24	21.200	21.550	94.000	15.000	14.800	11.500
31	21.200	21.538	94.000	15.000	14.800	12.000

THE above quotations for major non-ferrous metals are our appraisal of the important United States markets, based on sales reported by producers and agencies. They are reduced to the basis of cash, New York or St. Louis. All prices, except gold and silver, are in cents per pound.

(*a*) Net prices at refineries on Atlantic seaboard. To arrive at the delivered New England basis add 0.300c. per pound, the average differential for delivery charges.

(*b*) Our export quotation for copper reflects prices obtaining in the open market and is based on sales in the foreign market reduced to the f.o.b. refinery equivalent, Atlantic seaboard. On f.a.s. transactions we deduct 0.075c. for lighterage, etc., to arrive at the f.o.b. refinery quotation.

Copper, lead and zinc quotations are based on sales for both prompt and future deliveries; tin quotations are for prompt delivery only.

Quotations for copper are for the ordinary forms of wirebars and ingot bars; cathodes are sold at a discount of 0.125c.

Quotations for zinc are for ordinary Prime Western brands. Zinc in New York commands a premium over the St. Louis basis equal to the freight differential. Contract prices for High Grade zinc delivered in the East and Middle West in nearly all instances command a premium of 1c. per pound over the current market for Prime Western but not less than 1c. over the *Engineering and Mining Journal's* average quotation for Prime Western for the previous month; the premium on Special High Grade in most instances is 1¼c.

Quotations for lead are for common lead.

Silver, Gold and Sterling

DAILY AND AVERAGE PRICES

Jan. 1948	Sterling Exchange "Checks"	Silver: (c) New York	Silver: London	Gold: London	Gold: (d) United States
1	Holiday	Holiday	Holiday	Holiday	Holiday
2	402.750	74.625	45d.	172s. 3d.	$35.000
3	(e)	(e)	(e)	(e)	35.000
5	402.750	74.625	45d.	172s. 3d.	35.000
6	402.750	74.625	45d.	172s. 3d.	35.000
7	402.750	74.625	45d.	172s. 3d.	35.000
8	402.750	74.625	45d.	172s. 3d.	35.000
9	402.750	74.625	45d.	172s. 3d.	35.000
10	(e)	(e)	(e)	(e)	35.000
12	402.750	74.625	45d.	172s. 3d.	35.000
13	402.750	74.625	45d.	172s. 3d.	35.000
14	402.750	74.625	45d.	172s. 3d.	35.000
15	402.750	74.625	45d.	172s. 3d.	35.000
16	402.750	74.625	45d.	172s. 3d.	35.000
17	(e)	(e)	(e)	(e)	35.000
19	402.750	74.625	45d.	172s. 3d.	35.000
20	402.750	74.625	45d.	172s. 3d.	35.000
21	402.750	74.625	45d.	172s. 3d.	35.000
22	402.750	74.625	45d.	172s. 3d.	35.000
23	402.750	74.625	45d.	172s. 3d.	35.000
24	(e)	(e)	(e)	(e)	35.000
26	402.500	74.625	45d.	172s. 3d.	35.000
27	402.250	74.625	45d.	172s. 3d.	35.000
28	402.500	74.625	45d.	172s. 3d.	35.000
29	402.500	74.625	45d.	172s. 3d.	35.000
30	402.500	74.625	45d.	172s. 3d.	35.000
31	(e)	(e)	(e)	(e)	35.000
AVERAGES FOR MONTH					
Jan.	402.679	74.625	—	—	35.000
AVERAGES FOR WEEK					
Jan. 7	402.750	74.625	—	—	—
14	402.750	74.625	—	—	—
21	402.750	74.625	—	—	—
28	402.550	74.625	—	—	—

Calendar week averages; New York Silver: Jan. 3rd, 74.625; 10th, 74.625; 17th, 74.625; 24th, 74.625; 31st, 74.625.

(*e*) No market (Saturday).

(*c*) Determined by Handy & Harman on the basis of market prices for bar silver, in cents per troy ounce .999 fine, in amounts of 50,000 oz. or more, nearby delivery, New York. Price quoted is in cents and one-eighth cent fractions, and is usually about one-quarter cent below the market to allow for delivery, carrying, and marketing. In addition to foreign silver, the quotation also applies to domestic and Treasury silver if such silver enters into the market. The Treasury's purchase price of newly mined domestic silver 90.5c. per troy ounce 1000 fine, effective July 1, 1946. London silver in pence per troy ounce, basis .999 fine.

(*d*) U. S. Treasury's gold price. Actual payment by the United States Treasury for gold in domestic and imported ore or concentrate is at 99.75 per cent of the price quoted by the Treasury, which is equal to $34.9125.

MARKETS—Trends and Prices

Miscellaneous Metals

(Monthly Averages)

Average prices of miscellaneous metals for December and January:

	Dec.	Jan.
Quicksilver, N. Y. flask	79.000	78.308
Antimony (a)	36.030	36.082
Antimony, bulk, Laredo	33.000	33.000
Antimony, in cases, Laredo	33.500	33.500
Antimony, Chinese (b)	.....	.....
Platinum, oz. troy	65.692	66.000
Cadmium (c)	175.000	175.000
Cadmium (d)	177.500	177.500
Cadmium (e)	180.000	180.000
Aluminum ingot	15.000	15.000
Magnesium	20.500	20.500

(a) New York, packed in cases, in lots of 5 tons or more but less than a carload. (b) Nominal. (c) Producer's price for commercial sticks. (d) Average producers' and platers' quotations. (e) Special shapes sold to platers.

E. & M. J. Weighted Index of Non-Ferrous Metal Prices

100 is composite for 1922-3-4. (Copper, Lead, Zinc, Tin, Silver, Nickel, Aluminum)

1938	73.67	1943	88.74
1939	77.71	1944	88.74
1940	79.22	1945	90.86
1941	83.49	1946	110.06
1942	86.80	1947	149.46

	1946	1947	1948
January	96.42	140.88	154.20
February	96.42	140.42	.....
March	96.42	150.71	.....
April	96.42	153.14	.....
May	96.42	154.03	.....
June	107.16	150.05	.....
July	117.11	148.73	.....
Atgust	113.32	149.35	.....
September	113.32	150.80	.....
October	114.25	151.05	.....
November	131.23	151.92	.....
December	142.19	152.48	.....

Official London Prices

Since Dec. 18, 1939, the British Ministry of Supply has named maximum delivered prices for the major non-ferrous metals. Prevailing delivered prices for consumers in the United Kingdom follow:

	Per Long Ton		
COPPER:	£	s.	d.
Electrolytic, high conductivity	132	0	0
Fire refined, high conductivity	132	0	0
Fire refined, high grade	131	10	0
Fire refined, min. 99.2 percent	131	0	0
Fire refined, min. 99.7	130	10	0
Hot rolled black wire rods	138	0	0
LEAD:			
Soft, foreign, duty paid	90	0	0
Soft, Empire	90	0	0
English refined	91	10	0
ZINC:			
Foreign (G.o.b.), duty paid	75	0	0
Domestic (G.o.b.)	75	0	0
Prime Western and debased	75	0	0
Refined and electrolytic	75	15	0
Minimum 99.99 percent	77	5	0
TIN:			
Ingot, 99 percent	519	0	0

Miscellaneous Metals, Ores, Minerals

Quotations cover wholesale lots, prompt shipment, f.o.b. New York, unless otherwise stated

MISCELLANEOUS METALS

(January 31, 1948)

Aluminum, ingot, 99 plus percent, lb. (base price)	15c
Antimony, spot, lb., 5 tons and up but less than carload, in cases	36.12c.
Bismuth, ton lots, lb.	$2.00
Cadmium, commercial sticks, lb.	$1.75
Calcium, lb. ton lots, 98 percent, cast	$1.85
Chromium, 97 percent grade, lb., spot	92c.
Cobalt, 97 to 99 percent, per lb.	$1.65
Indium, troy oz.	$2.25
Nickel, electrolytic cathodes, lb., f.o.b. Port Colborne	33¾c.
Magnesium, 99.8 percent, carloads, lb., producer's plant	20½c.
Palladium, troy oz.	$24.00
Platinum (Official quotation wholesale lots) troy oz.	$66.00
Quicksilver, flask of 76 lb., 25 flasks or more	$77.00
Selenium, 99.5 percent, lb.	$2.00
Silicon, minimum 97 percent, spot, carloads, lb.	14.75c.
Tellurium, lb.	$1.75 nom.
Thallium, 100 lb. or more, lb.	$15.00
Titanium, 96 to 98 percent, lb.	$6.00@$7.00

METALLIC ORES

Beryllium Ore, 10 to 12% BeO, f.o.b. mine, per unit	$16.00@$18.00
Chrome Ore, per long ton, f.o.b. cars Atl. ports, dry 48% Cr_2O_3, 2.8 to 1 ratio	$37.50
48% Cr_2O_3, 3 to 1 ratio	$39.00@$40.00
Iron Ore, Lake Superior, Lower Lake ports, long ton:	
Old Range bessemer	$5.95
Mesabi bessemer	$5.70
Old Range non-bessemer	$5.80
Mesabi, non-bessemer	$5.55
Lead, (Galena) 80 percent, Joplin, Mo., ton	$195.65
Manganese Ore — Per long ton unit of Mn, basis 48 per cent manganese, subject to premiums and penalties, f.o.b. cars Atlantic and Gulf ports, duty paid, 65@67c.	
Molybdenum Ore, 90%, per lb. of MoS_2 f.o.b. mines	45c.
Tungsten Ore, per unit of WO_3:	
Foreign, 60 percent, duty paid	$30.00
Domestic, scheelite, 60 percent and upward	$30.00
Vanadium Ore, per lb. of contained V_2O_5 f.o.b. mines	27½c.
Zinc Ore, Prime, 60 percent concentrate, Joplin, Mo., per ton	$78.00

METALLIC COMPOUNDS

Arsenious Oxide (arsenic trioxide) lb., in bbl., carload lots, delivered	6¼c.
Cobalt Oxide, 70 to 71 percent, lb., ceramic grade	$1.27½
Copper Sulphate, 100 lb.	$7.60

ALLOYS

Beryllium Copper, 4 percent Be, per lb. of contained Be	$20.50
Ferrochrome, 65 to 70 percent, per lb. of Cr contained	18.60c.
Ferromanganese, 78 to 82 percent, gross ton	$145.00
Ferromolybdenum, 55 to 65 percent Mo, lb of Mo, contained	95c.
Ferrosilicon, 50 percent, per lb. of contained Si	8.80c.
Ferrotungsten, 75 to 80 percent, lb. of W contained	$2.25
Ferrovanadium, per lb. of V delivered	$2.90
Silicomanganese, 1½ percent C, per lb. contracts	7.80c.

NON-METALLIC MINERALS

Asbestos, f.o.b. Canada (Quebec) mines (U.S. funds), ton:	
Crude No. 1	$800
Crude No. 2	$302@$410
Spinning fibers	$170@$230
Paper stock	$43@$65
Shorts	$20@$38
Vermont, f.o.b. Hyde Park:	
Shingle stock	$82.50@$91.50
Paper stock	$58.00@$65.00
Waste	$43.00
Refuse or shorts	$20.50@$38.50
Barytes, f.o.b. mines:	
Georgia, crude, per long ton	$11.50@$12.00
Missouri, 93 to 94 percent $BaSO_4$, per short ton	$9.00@$9.50
Bauxite, long ton:	
Domestic, crude, 50 to 52 percent (not dried)	$4.00@$5.00
Domestic, chemical, 55 to 58 percent	$7.50@$8.50
Domestic, abrasive, 80 to 84 percent	$16.50
China Clay, f.o.b. mines, ton:	
South Carolina and Georgia, No. 1, airfloated, bulk	$6.75@$8.00
Maryland, ball, bulk	$7.00@$9.00
Feldspar, bulk ton:	
Potash feldspar, 200 mesh	$17.00
Glass spar, white, 20 mesh	$11.75
Fluorspar, f.o.b. mines, bulk, Kentucky and Illinois 70 percent, all rail movement, ton	$35.00
Acid 97 and 1 percent, bulk, ton	$40.00
Fuller's earth, f.o.b. Georgia or Florida, ton	$7.00@$14.00
Magnesite, per ton dead-burned, f.o.b. Washington	$24.00
Mica — Domestic f.o.b. mines. Punch, 6 to 15c. per lb. according to size and quality. Sheet, clear, 1½x2 inch, 60 to 65c.; 2x2 inch, 95c. to $1; 2x3 inch, $1.35; 3x3 inch, $1.80; 3x4 inch, $2.25; 3x5 inch $3; 4x6 inch, $4; 6x8 inch, $6. Wet ground, very fine, $90 per ton. Bulk sales, dry ground, $32.50 per ton. Scrap, 28 and up, depending on quality.	
Ocher, Georgia, ton, in sacks	$24.00
Pyrites, Spanish, per long ton unit of S, c.i.f. Atlantic ports	12@14c.
Sulphur, Texas, mines, long ton	$16.00@$18.00
Talc, f.o.b. works, ton:	
New York, air-floated	$18.50@$20.00
Vermont, extra white	$12.50
Tripoli, Missouri, ton:	
40 mesh, cream colored	$14.50

IRON AND STEEL

Pig Iron, Valley furnaces, gross ton: Basic	$39.00
Steel, baseprice, Pittsburgh Billets, gross ton	$47.50
Structural shapes, 100 lb.	$2.80

WASHINGTON REFLECTIONS

McGraw-Hill Washington News Bureau

Congressmen Plan Survey of Domestic Minerals

A lengthy review of domestic mineral resource problems is slated to begin before the House Mines and Mining Subcommittee in mid-February. Rep. William Lemke of North Dakota will direct the committee investigations.

The hearings will be taken up commodity by commodity. Manganese will head the list, followed by chromium, synthetic liquid fuels, petroleum, copper, lead, zinc, antimony, mercury and tungsten, in that order.

Object of the hearings is to determine what should be done to utilize domestic resources of the short minerals and what is needed to maintain the domestic mining industry in a healthy state. Such factors as national defense, stockpiling, tariffs, Governmental controls, conservation and subsidies will be brought into the hearings.

Rep. Lemke has told reporters that his committee plans to take an inventory of the country's mineral resources, and that Government officials and representatives of the mining industry will be called upon for information on reserves, requirements, production and stockpiling needs.

It is evident that discussion on tariffs as a method of helping the mining industry will be kept to a minimum. Members of the committee at preliminary conferences pointed out any attempt to erect a tariff fence "would run into a stone wall."

Attack of the shortage question, therefore, will in all probability be directed along the line of subsidies and tax assistance.

Bureau Reports 1947 as All-Time Peak Production

The total value of minerals and mineral products produced in the United States and Alaska in 1947 reached an all-time peak of $12,400,000,000, exceeding the 1946 peak by 40%, according to a preliminary estimate by the Bureau of Mines.

A new high in physical volume of production accompanied the dollar increase. The total quantity of minerals produced was approximately 5% over the peak recorded in 1944.

Of the three major classes of mineral products, the greatest gain last year (65%) was made by metals. This was primarily due to the cuts in 1946 production resulting from strikes and supply difficulties, the Bureau report states. Value of fuels increased 36%. More crude petroleum and natural gas was produced than ever before. Nonmetallic minerals gained 22% in value of production. Total value of metallic products in 1947 was $3,000,000,000, as compared to $1,823,000,000 in 1946.

The steel industry last year had its best year since the wartime peak in 1944, and production is estimated to have totaled 84 million short tons of ingots and castings, an increase of 26% over 1946. Raw material shortages, notably scrap, coke and pig iron, prevented 1947 from being a record production year, according to the report. Pig iron and iron ore tonnages, however, increased 29 and 33% respectively.

Molybdenum and vanadium showed production gains of 29 and 84%, respectively, over 1946, and returned to approximate 1940 levels. Domestic output of manganese declined 3%, that of chromium 63%, and tungsten 42%.

Copper smelted from domestic ores last year amounted to about 860,000 short tons, a 43% gain over strike-harassed 1946, but was still far short of supplying domestic demand. As the average annual price of copper increased nearly 50% during the year, the value of output jumped 107%. Although the end of the Premium Price Plan in June forced a number of zinc mines to close, only in the central states was the impact sufficient to precipitate a regional drop in production. Smelter output of zinc from domestic ores, estimated at 516,000 short tons, increased 12% in quantity and 38% in value. Despite the heavy demand for lead, mine production was below the 1939-1945 level. Because of the shortage, a 16% increase in smelter output, an estimated 340,000 tons, meant a 101% gain in value over the previous year.

Aluminum production, estimated to have totaled 570,000 short tons of primary metal, was 39% over 1946. The 12% gain in domestically mined bauxite was insufficient to meet demand and necessitated the highest import rate in history. Primary magnesium metal output was about 12,400 short tons, forced down by stocks of 75,000 tons of sheet and scrap.

Gold production in 1947 was one-third over the previous year and the largest since 1942. Silver output was about one-half greater than in 1946, although notably below prewar and early war years.

Full-time operation of smelters permitted increased recoveries of by-product arsenic, cadmium, bismuth and minor metals. Mercury output dropped about 10%. Ilmenite shipments exceeded 300,000 short tons and nearly equaled the 1945 record high. Rutile shipments were reduced substantially. Mine output of antimony and zircon were close to record levels.

Total value of non-metallic minerals produced in 1947 was $1,600,000,000, about 22% over the previous year. The most outstanding increases were made by the building materials, which were at or near record levels. Demand for most other non-metallics was at a very high level. Among the commodities that attained record production in quantity as well as value were sulphur, potash, phosphate rock, boron, feldspar, kaolin, stone, cement, and vermiculite.

The million pounds of sheet mica produced was much below the wartime level, principally because of competition with imports. Production of scrap mica, however, was near a record high.

Bureau and Survey Seek Larger Appropriations

The U. S. Bureau of Mines has submitted to Congress a budget calling for an expenditure of $21,942,300 for fiscal 1948, almost double the appropriation for this year. However, with the exception of several activities now in a favorable spot over national defense or politics, most budget items will probably be cut below this year's level.

Nevertheless, the largest items in the Bureau budget – synthetic liquid fuels and coal mines inspections–are those that have a chance of obtaining most of what is asked. The synthetic liquid fuels program (making oil from shale and coal) was given a big boost by Secretary of Defense Forrestal recently when he appeared before the Congress. The utterances of private industry at the same hearing, to the effect that Governmental research in the field is almost mandatory, helped the case considerably. Also, John Lewis' coal mines investigation battle with the Government late last year resulted in the Congress suggesting that more inspectors should be hired. The new budget proposes more frequent inspections of coal mines.

The major items in the budget for next year, compared to the present appropriations, follow: Operating rescue cars and investigations of accidents, $1,165,000 ($1,148,000 this year); coal mine inspections and investigations, $2,895,000 ($1,875,000); testing fuels, $506,600 ($400,000); anthracite mining investigations, $105,000 (same); synthetic liquid fuels, $9,750,000 ($3,000,000); mineral mining investigations, $428,300 ($440,000); investigation and development of mineral deposits, $1,750,000 ($1,060,000); coal investigations, $350,000 ($75,000); oil and gas investigations, $606,000 ($600,-

000); mining experiment stations, $1,385,000 ($1,060,000); metallurgical research and pilot plants, $1,895,000 ($1,000,000); economics of mineral industries, $808,500 ($680,000).

The Geological Survey's $16,005,000 budget for next year is about 50% over that granted this year. About half of the increase is to cover increased mapping requirements. The Survey is just as liable for budget cutting as the Bureau of Mines, although the President made a point of the necessity for increased mineralization mapping work in his message to Congress.

The Survey budget is as follows: Topographic surveys, $6,580,000 ($3,000,000); geologic surveys, $2,988,000 ($2,300,000); mineral resources of Alaska, $400,000 ($250,000); gaging streams, $3,496,700 ($2,625,000); classification of lands, $425,000 ($245,000); mineral leasing, $710,000 ($650,000).

Stockpiling Rate Probably Will Be Stepped Up

The armed forces' 285-million-dollar budget for stockpiling in fiscal 1949, plus a forthcoming request for a supplementary appropriation of 75 million dollars to wind up buying this spring, points to a determination to stockpile regardless of the cost.

It also means that this year (fiscal 1948) the stockpilers have spent all their appropriation of 100 million dollars. Heretofore, stockpilers have wound up the fiscal year with money still in the till.

What an expenditure of this size would do to already tight markets in several minerals is the basis for a "behind the scenes" fight between the military services and the Commerce Department. Commerce has long contended that the stockpilers should not purchase materials which are in short supply domestically. They point to a clause in the stockpiling act which, they say, mandates the Munitions Board from buying when there is a civilian deficiency.

The Munitions Board also points to the same clause in the act, which, they contend, says that the stockpilers will refrain – "insofar as is practicable"–from buying on a tight market. The Board's opinion is that it is no longer practicable to withhold buying.

Although the fight between Commerce and the military services will have to be settled at Cabinet level, it is evident that President Truman is on the side of the services. In his message to the Congress at the first of the year, the President said, "aside from the National Military Establishment, the most important expenditures for defense activities in 1949 will be for military stockpiling, particularly to build up reserves of those raw materials and supplies which must be obtained from overseas sources that might be cut off in time of war. Although procurement of materials for the strategic stockpile is behind schedule," he said, "the estimated expenditures for procurement for the fiscal year 1949 are held to 285 million dollars because of the urgent need for such materials to promote world recovery, and the prevailing shortages with attendant high prices."

Although the President's words would indicate that stockpiling should be kept at a minimum, he advocates an expenditure almost triple that of any previous year. He points out in his message that, in addition to new procurement, transfers from Government-owned stocks to the stockpile will continue and by the end of fiscal 1949 the value of these transferred materials will amount to an estimated 400 million dollars. During the next fiscal year 20 million dollars will be spent for processing the Government surpluses.

Another indication of the stockpilers' determination to "get something on the shelf" is their apparent sanction of the Ploeser bill (HR3947) which would allow the Munitions Board to contract for domestic production of strategic materials at prices higher than the current market quotation. This would allow long-term contracts for marginal production of the scarce metals and minerals. The Board heretofore has been against any such subsidy measure.

MMSW Expected to Break With PAC Over Wallace

The likelihood that the CIO Mine, Mill and Smelter Workers will not go along with the CIO executive board's condemnation of Henry Wallace's third party candidacy kept MMSW President John Clark from casting a vote on this issue at his first meeting as a member of the CIO board in Washington January 22. The CIO resolution opposing a third party was carried in a split vote, 33 to 11.

CIO President Philip Murray explained afterward that, although the executive board's action was not binding on affiliated unions, they were under "moral obligation" to follow the decision.

Officers of ten CIO unions – members of the group frequently identified as under Communist influence – voted against the resolution opposing a third party. Murray's disclosure for the first time of how the executive board members voted seemed to indicate he was losing patience with the Communist party-liners.

Practically the same opposition was raised against the CIO's support of the Marshall Plan for aiding Europe. This may be the signal for trouble ahead from some of these unions once the Marshall aid gets rolling.

MMSW's stand on Wallace will be considered at the union's executive board meeting February 16 in Salt Lake City. The union's leaders have been very partial to Wallace and probably will endorse Wallace. If so, they will be working against CIO's Political Action Committee.

Control of Non-Ferrous Metals to Be Considered

Lying in no man's land between present Governmental "wartime controls" (tin and antimony) and the new industry-Government voluntary allocations program (iron and steel, farm machinery, freight cars, and petroleum), are several metals and minerals that have not yet been mentioned in the talk on control over industrial materials shortages.

Commerce Secretary W. Averill Harriman, in testifying on allocation authority before the Joint Congressional Committee on the Economic Report, said that in addition to continuing existing controls on tin, antimony, and nitrogenous fertilizers, it might be necessary to establish allocation of steel, soda ash, caustic soda, aluminum, "other non-ferrous metals," heavy electrical machinery, and several building materials.

With voluntary control of steel already under discussion, and farm machinery, freight cars and petroleum next in line, the "other non-ferrous metals" group seems slated for consideration at some time within the next several months. Of the latter group, lead, copper, and aluminum are the most likely for action. Commerce's program is to try voluntary controls first, and if they fail to work, then to ask Congress for specific controls that will work.

Dropped from the wartime controls system by Commerce last summer, lead has been heading for the "critically short" category ever since. Should the shortage (already estimated at 200,000 tons despite a record peacetime supply) become a "national emergency" in scope, the metal would be placed before the voluntary-control experts for investigation. Any controls worked out would concern only soft lead and soft lead scrap. There is enough antimonial lead scrap to supply the market.

Either aluminum or copper should follow the heavier metal into the conference rooms. Aluminum pig and sheet will be about 20% short of demand this year, according to estimates based on present demand. Any new demand for the metal will add just that much more to the deficiency. At present it is estimated that the shortage will amount to about 350 million pounds.

Domestic demand for copper in 1948 is now estimated at 1,200,000 tons. Domestic production should total about 850,000 tons. Imports, which last year totaled about 350,000 tons, normally would make up the difference between demand and domestic production.

During this year, however, with a Marshall Plan cutting down U. S. imports of the metal, the balance may not be achieved. Best Washington estimates now are that for the year the country will be short from 200,000 to 300,000 tons of the metal.

NEWS OF THE INDUSTRY

Duluth Meetings for Mining Men Draw Large Attendance From Lake Superior Iron Ranges

Expressing the hope that the new Minerals Advisory Council might provide the means whereby mining operators and the Government can harmonize their policies for the national good, Dr. James Boyd, director of the U. S. Bureau of Mines, told the Minnesota Section of the A.I.M.E. at their annual dinner in Duluth Jan. 12 that they can reduce the clamor for controls and regulation to a minimum to the extent that they can cooperate. Government agencies, such as the Bureau and the Geological Survey, are not well enough informed on the total reserves of iron ores in this country to issue informed releases to the public that would dispel the popular fear that the ore supply might prove inadequate. The proper assembly of such data will depend, he said, on the confidence in the integrity of these agencies and in closer cooperation between them and industry.

Thinking has not crystallized as to stockpiling iron and steel or iron ore, continued Dr. Boyd. The Munitions Board has not listed ore for stockpiling because it thought productive capacity ample for emergency needs. Other factors, however, require thought. Time will be vital in a future emergency, and national reserves must be in such form that they embrace a stockpiling of manpower, transportation and energy as well as of physical availability of raw materials. The proposed shift to taconite would result in a loss of flexibility in production capacity—an important factor from the defense viewpoint. If an ore stockpile were decided upon, it should be closer to consuming areas. However, since expansion of blast-furnace construction is hard to accomplish in wartime, stockpiling would probably embrace pig iron rather than ore. This would involve much money.

A Geophysical Survey From the Air

How some 15,000 sq.mi. of northern Minnesota had been surveyed with the airborne magnetometer by the U.S. Geological Survey, in part at its own expense and in part sharing the cost with the State, was told by Dr. G. M. Schwartz, of the Minnesota Survey, speaking at the morning session. Eventually, the entire area north of the Elk River would be surveyed in this manner. The flying involved is the easy part, according to the speaker, who said it is the compilation of the data that is time-consuming. North-south lines a mile apart were flown, corresponding roughly to the section lines. Cost at present is estimated at approximately $2 per linear mile, including the cost of operating the plane and of its crew and the ground crew. This excludes overhead and investment in the plane.

Labrador's Iron Ore

The potentialities of Labrador as a producer of iron ore are impressive, in the opinion of Dr. Joseph A. Retty, the next speaker. Dr. Retty is chief geologist for Labrador Mining and Exploration Co., and has spent the last eleven years in that northern region. His company, financed jointly by Hollinger Consolidated Gold Mines and M. A. Hanna Co. with Hollinger retaining control, has disclosed 36 occurrences of iron ore on its huge concession. Of these only a fraction has been drilled thus far. The studies made indicate that the deposits occur as concentrations along synclines and thrust faults, the latter being the most prominent structural features. The occurrences are found in the northwestern part of the concession along a 90-mile southeast-northwest stretch. The ore, mostly hematite and silica, is found wholly within the iron formation. The outstanding occurrence to date is that of Sawyer Lake. Dry analyses of samples from eleven occurrences, taken in 1945, and now regarded as out of date, ranged from 58.8 to 68.40 in iron and manganese, from 2.11 to 7.91 in silica, and from 0.01 to 0.148% in phosphorus. More recent data are to be released first to shareholders. The objective of the present work is to disclose 300 million tons of ore. This achieved, the construction of a 350-mile railroad to the St. Lawrence will be considered.

Present high labor costs mean that heavy machinery must be as efficient as possible, and automatic controls will help in cutting costs, according to F. R. Gruner, research engineer for Allis-Chalmers, who followed on the program. He confined his discussion to mechanical design. To design properly, one must know the forces involved. Instead of determining these by rule of thumb, as formerly, an effort is now made to get at the matter in a more fundamental way, by accumulating basic data, as on the strength of various materials, and then expressing them in a formula. The knowledge of materials has increased greatly in the last ten years.

A description of the Embarrass River diversion and the surface drainage of Embarrass Lake mine was given by James Stuart, now chief engineer of Meriden Mining Co. but formerly with Pickands, Mather & Co. This concluded the technical sessions of the Minnesota Section.

E. P. Scallon and W. L. Taylor were elected chairman and vice chairman, respectively, of the Minnesota Section, and Charles O'Connell secretary-treasurer.

The sessions of the ninth annual Mining Symposium began the following day, held in the Hotel Duluth, as the meeting of the day before had been. Conducted by University of Minnesota Center for Continuation Study, the general topic of the competitive position of Lake Superior iron ore was introduced by Prof. T. L. Joseph, head of the School of Mines. J. M. Nolte, Dean of University Extension, and Norman Johnson, Director of the Center for Continuation Study, also spoke briefly.

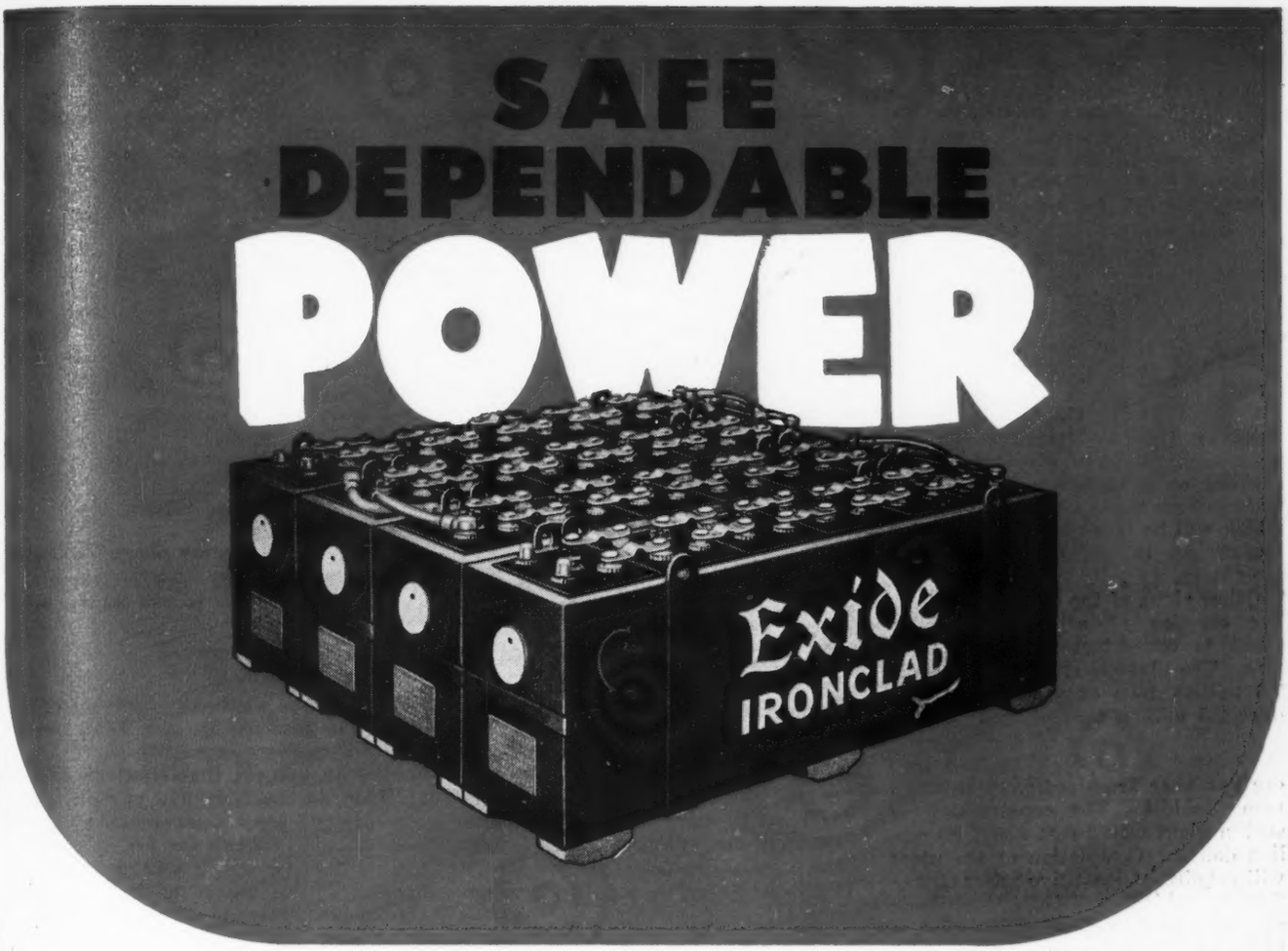
The first address, by Hugh M. Roberts, consulting geologist of Duluth, bore directly on the central topic. Scanning world maps, Mr. Roberts reviewed the possibilities of the major deposits of both hemispheres for competition with lake ores as a source of supply for United States furnaces. His findings were that none of them can compete with the domestic ores mentioned, in the region between the Appalachians and the Rockies and north of the mountains of Kentucky. Lake Superior reserves of merchantable ore he put at two billion tons as of May 1, 1945, citing an estimate by William Crago, of Duluth. Of this tonnage, Minnesota, had 1,572,000,000 and the Mesabi 1,400,000,000 tons.

Franklin G. Pardee, mining engineer for the Michigan Geological Survey, discussed the occurrence of low-grade iron ore in Michigan. Two authorities, Mr. Pardee said, had pointed out that the silica in many of the Michigan formations is so intimately mixed or chemically combined with the hematite that gravity concentration is not applicable. The speaker took the position, however, that eventually suitable methods would be worked out. He presented an estimate of Michigan's low-grade reserves, his total for crude ore being 1,810,000,000 tons per 100 ft. of depth and for shipping ore 724,000,000 tons per 100 ft. of depth. Of the total, 56% could be mined by open-pit methods. The total was broken down by districts thus:

MILLIONS OF TONS

	Crude Ore	Shipping Ore
Gogebic Range ...	300	120
Dickinson County.	120	48
Iron County	525	210
Marquette Range .	865	346

(*Continued on Page* 166)



EXIDE-IRONCLAD BATTERIES keep them moving swiftly, steadily throughout each shift

You can always count on safe, dependable power when your trammers, locomotives and shuttlecars are equipped with Exide-Ironclad Batteries. They are the only batteries that have ALL FOUR of these vital characteristics—high power ability, high electrical efficiency, ruggedness, long life. *The average life of all Exide-Ironclad Batteries renewed in locomotive and shuttlecar service during the past year was 73.4 months.*

Exide-Ironclad Batteries differ from all other batteries. One major difference is in the construction of the positive plate, which consists of a series of slotted tubes containing the active material. So fine are these slots that, while permitting easy access of the electrolyte, they retard the active material from readily washing out... thus assuring years of safe, dependable, day-in-and-day-out haulage service.

If you have a special battery problem, or wish more detailed information, write for booklet Form 1982.

THE ELECTRIC STORAGE BATTERY COMPANY, Philadelphia 32 • *Exide Batteries of Canada, Limited, Toronto*

Reserve Mining Co. Permitted To Dump Tailings in Lake

The Water Pollution Control Commission of Minnesota granted the Reserve Mining Co. permission on Dec. 16 to dump tailings from a proposed taconite treatment plant into East Beaver Bay of Lake Superior. The bay is approximately 40 miles east of Babbitt on the East Mesabi Range, and 55 miles northeast of Duluth. The commission stipulated that the tailings must not affect public water supplies or fish life adversely, discolor the water, or interfere with navigation.

Reserve Mining Co., which is managed by Oglebay-Norton & Co., of Cleveland, plans to start work this summer on a harbor costing from 8 to 10 million dollars near Beaver Bay, which will be large enough to accommodate up to six Great Lake ore freighters.

Other plans of the company call for the erection of a 50-million-dollar plant to concentrate magnetic taconite. The plant is expected to handle 7.5 million tons of taconite, to produce 2.5 million tons of iron ore per year. Eventual aim of the company is to produce 5 million tons of iron ore per year from company holdings near Babbitt. The construction of such a plant would cost about 80 million dollars. Completion of the plant will require at least five years. Other factors which will affect ultimate operation are the rate of depletion of high-grade iron-ore reserves and the demand for steel.

Owners of the Reserve Mining Co. are also sharing in the cost of a pilot plant near American Rolling Mill's Ashland, Ky., plant which will experiment with pelletizing taconite concentrates by a balling and heating process. Capacity of the 500,000-dollar plant is expected to be 175 to 200 tons per day.

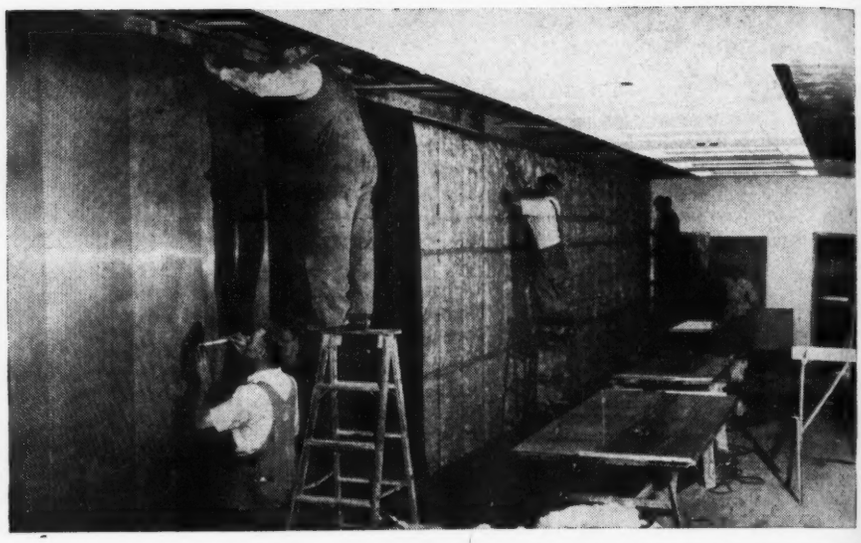
Economists Committee Calls For Free Gold Circulation

In mid-January the Economists National Committee on Monetary Policy, as part of an 18-point program to halt inflation, recommended a gold-coin monetary standard, i.e., restoration of free circulation of gold.

The recommendation was based on the principle that availability of gold would restore the public's veto power over Government extravagance, as a strong public demand for gold would be a warning of lack of confidence in fiscal policies. This veto power has been denied the public since 1934.

The committee called for returning to the people greater control over Government "use and abuse" of the public purse and reversal of the "pronounced trend toward a Governmentally managed economy."

Other points in the program called for Government economy, tax reductions, debt reduction, abandonment of feather-bedding, and lower profits.



ALUMINUM AND FIBERGLAS are used to construct walls in the new Owens-Corning Fiberglas Corporation building, New York. Sound-absorbent fiberglas batts are covered with porous fiberglas mats. Perforated aluminum sheets cover the mats to give the wall its finished surface.

Zinc Industry Acclaims Non-Discriminatory Rate

In regard to action taken by the General Traffic Committee of the American Zinc Institute in presenting testimony and exhibits at the freight rate hearing in Salt Lake City Nov. 17 to 19, inclusive, the Institute declares:

"We are pleased to report that the Commission in authorizing a 20 percent interim increase in interstate freight rates until June 30, 1948, which cancels and supersedes the interim increase of 10 percent in effect since Oct. 13, 1947, made the following exceptions:

"(a) Freight rates on zinc ore and concentrates to be increased 20c per gross or net ton, as rated (not 20 percent) over rates in effect Jan. 1, 1947. This is the same increase that was authorized for iron ore and aluminum ore and concentrates.

"(b) Zinc metal was limited to the same increase as authorized for iron and steel articles and aluminum—20 percent increase over rates in effect Jan. 1, 1947, with provision for reparation claims where this increase exceeds 11c per 100 lb. (or $2.20 per net or gross ton, as rated).

"We understand that effective Jan. 13, 1948, the carriers will publish the increase and show a maximum of 11c per 100 lb. (or $2.20 per net or gross ton, as rated), which will make unnecessary the filing of reparation claims except for the period Jan. 5 to 12 inclusive."

Howard I. Young, president of the American Zinc Institute, has expressed to Walter G. Patton, chairman of the General Traffic Committee, the Institute's appreciation for the effective work of his committee and for the gratifying results obtained in this interim decision. It is hoped, Mr. Young remarked, that the final decision of the Commission in Ex Parte 166 will continue the same non-discriminatory treatment, limiting the increase on zinc ore and concentrates to the same increase authorized on iron ore and aluminum ore and concentrates, and limiting the maximum increase on zinc metal to the same increase authorized on iron and steel articles and aluminum.

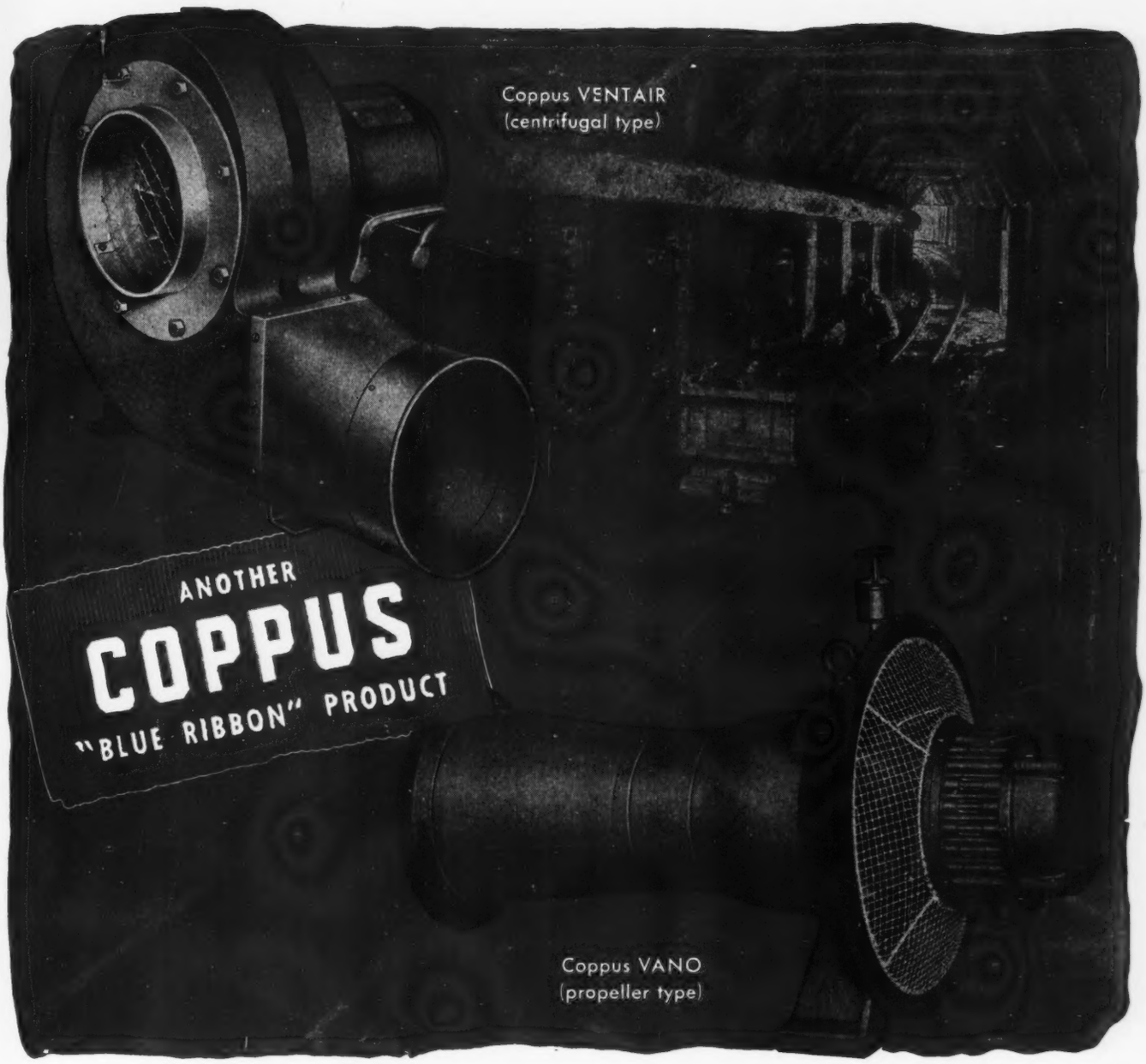
Washington Mining Institute and AIME Meeting Covers Processes, Resources, Economics

The 21st annual Mining Institute meeting, held at Seattle under the auspices of the School of Mineral Engineering, University of Washington, was held on Jan. 15, with a good attendance and an interested audience.

The morning session opened with a discussion by Prof. H. Gordon Poole on "The Humphreys Spiral Concentrator." Pointing out its advantages of low operating costs and slight depreciation, he characterized it as a classifier on homogeneous feed and a separator on classified feed, which does essentially the same kind of a job as shaking tables. He pointed out that coarse material, no matter how heavy, is carried outward by the faster moving water above the zone of skin friction, as is also true in tabling.

Wolf G. Bauer, consulting ceramic engineer, discussed fluidization of solids. Describing the wide field of

(*Continued on page* 168)



Two Blowers . . . One Purpose: 30 to 100% More Air

Why two totally different blower types? Because the requirements of mine ventilation fall into two entirely different categories.

For high pressures, long pipe lines, use the Coppus VENTAIR (centrifugal type). For medium pressures, shorter pipe lines, the Coppus VANO (propeller type) is best. One or the other will give you more air per given power consumption than other blowers — from 30% to 100% more. Can be used as blowers or exhausters, capacities up to 90,000 CFM, with compressed air or electric motor drive.

Only Coppus makes both types. And, for quick recognition, each wears the famous "Blue Ribbon," distinguishing mark of top-quality engineering, materials and performance. This blue band is your guarantee of better mine ventilation . . . Look for it.

Representatives listed in MINING CATALOGS. Other Coppus "Blue Ribbon" products: steam turbines, gas burners, heat killers, air filters, blowers and exhausters for special purposes. See also THOMAS' REGISTER . . . Coppus Engineering Corporation, 282 Park Ave., Worcester 2, Mass.

COPPUS ENGINEERING CORPORATION
282 Park Avenue, Worcester 2, Mass.

Please send: Bulletin 130.

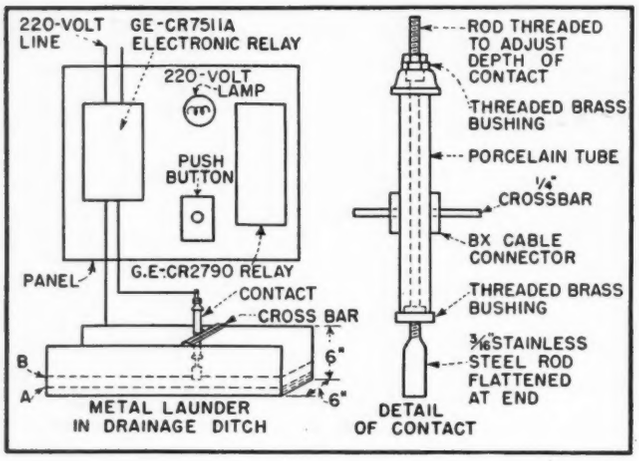
Name.....

Company.....

Address.....

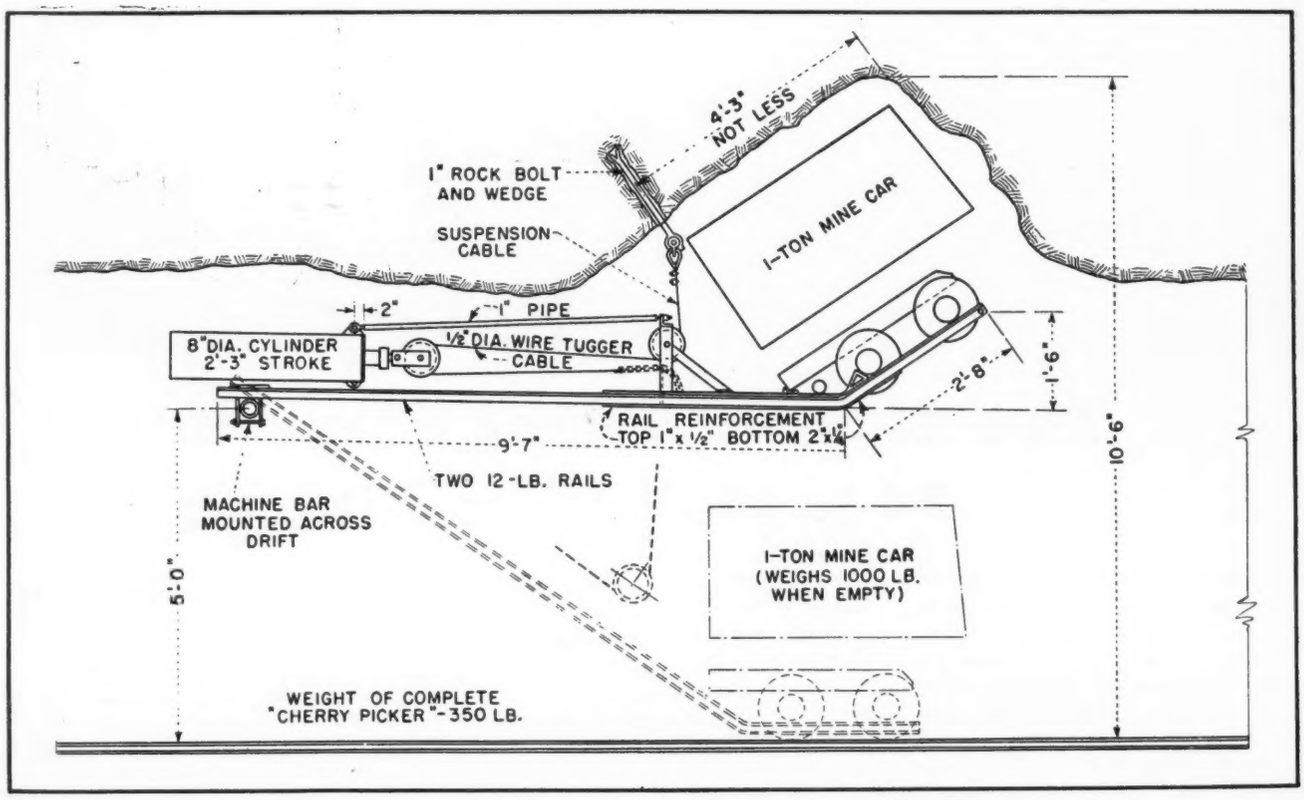
OPERATING IDEAS

Electronic Device Indicates Pump Operation



This electronic device was designed by Phil Keast, master mechanic, Empire Star Mines Company, Ltd., Grass Valley, Calif., to enable pump men to check on the performance of three pumps connected in series in an auxiliary pump station, 3,000 ft. away from the main-level pump station. The pumps operate for five-minute periods three times per hour, and discharge into a ditch which drains to the main station.

Formerly operators made two or three inspection trips to the auxiliary station to check performance. This required a 15 to 20-min. wait each time, and careful observation of the water level in the ditch. This information is now indicated by a red lamp on a control panel at the main-level station (see diagram) which burns if the pumps operate during the temporary absence of the pumpmen. When the operator finds the red light burning, he presses a push button which de-energizes relay GE-CR2790. This turns out the lamp, and energizes the electric relay on the left of the panel (GE-CR7511A). If the pumps start up, water flowing in the metal launder in the drainage ditch raises from level "A" to level "B", thus making contact with a metal probe which actuates the electronic relay. This in turn closes relay CR2790 which lights the red lamp and de-energizes the electronic relay CR7511A.



Retractable-Type "Cherry Picker"

THIS "CHERRY PICKER" was designed by R. O. Udall, assistant general superintendent, Pioneer Gold Mines of B.C., Ltd., British Columbia, Canada. Two 12-lb. rails form the main part of the frame. An air cylinder pulls on a suspension cable which raises the frame supporting the empty car into a recess blasted out of the back of the drift. The 350-lb. cherry picker can be installed in ten minutes. In some headings, one-ton cars were switched and loaded at an average rate of two minutes per car.

For 33% More Units Per Ton

with equivalent steel tonnage

USE **J&L OTISCOLOY**

HIGH-TENSILE STEEL

You can begin to balance your production with demand by making more units per ton of steel. Less steel per unit is made possible by the extra strength of J&L Otiscoloy High-Tensile steel. This saving in dead-weight over products made of carbon steel has been used to advantage by many manufacturers who reduce the steel per unit 25%, increase their unit production 33%. Write for full information.

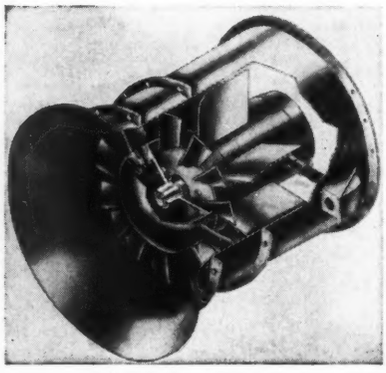
J&L STEEL

JONES & LAUGHLIN STEEL CORPORATION

PITTSBURGH 30, PENNSYLVANIA

EQUIPMENT NEWS

UNDERGROUND DIESEL TRACTOR at work in one of Eagle-Picher's mines near Cardin, Okla. The oxygen bottle behind the driver's seat feeds oxygen into the exhaust manifold in controlled quantities that burn any carbon monoxide in the exhaust gases to dioxide, which is ejected in quantities harmless to men.

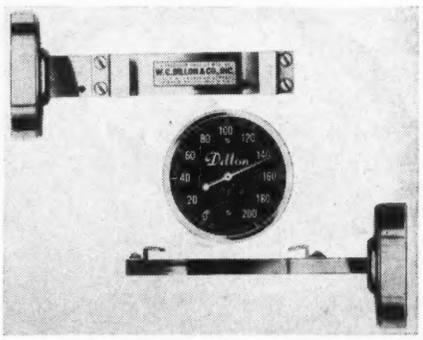


Adjustable-Blade Fans

Adjustable-blade, axial-flow fans for all heating, ventilating, and air conditioning requirements are now offered in a new and complete line made by Joy Manufacturing Co., Oliver Bldg., Pittsburgh 22, Pa. Known as the Axivane, Series 1000, the new fans are designed for a range of pressures up to 9.60 water gage, and volumes up to 100,000 cfm. All told, there are 124 different models of the Axivane fans, embodying various sizes, hub diameters, motor frame sizes, and speeds.

For Driving Studs

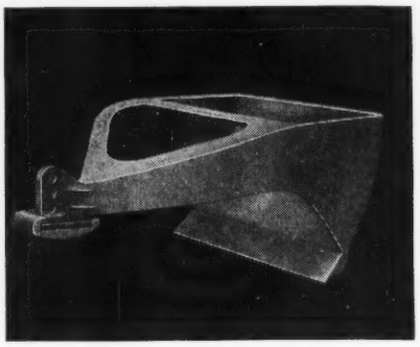
Driving threaded or headed studs into steel plate or concrete in order to hang pipe or conduit is a matter of seconds with the M.S.A. Model B power driver, recently announced by Mine Safety Appliances Co., Pittsburgh 8, Pa. Weighing 4½ lb., the driver gets its punch from a small blank cartridge. It drives in the studs so that they will hold under a tension of thousands of pounds.



THE FLAT STEM on this thermometer allows it to be clamped to bus bars, switch blades, engine blocks, or any flat surface where a temperature reading is wanted. A variety of stem sizes, dials, and temperature ranges is available. Write W. C. Dillon & Co., Inc., 5410 West Harrison St., Chicago 44, Ill.

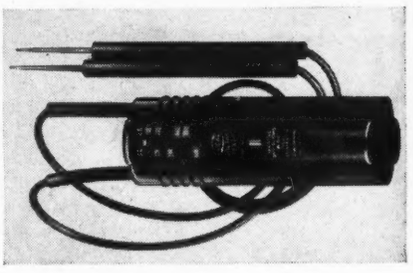
Motorized Track Car

Supervisors can get around open pit haulage ways a lot faster with the new motorized light track cars now offered by Light Inspection Car Works, Hagerstown, Ind. Formerly built only in pedal-operated models, the car now can be supplied with a small gasoline engine that will run the car 50 miles on a gallon of gasoline at a speed of 20 m.p.h The new car weighs 140 lb., but it can carry a 400-lb. load. It can be stopped with a full load from top speed and removed from the track by one man, all in 16 seconds. List price of the car is $275, f.o.b. Hagerstown.



One-Piece Manganese Scraper

Columbia Steel Casting Co., Inc., Portland, Ore., announces the manufacture of a new one-piece manganese steel scraper, which is made of that metal throughout, and in which only two bolts are used, the two that fasten the replaceable shoe. The cutting blade is mounted with countersunk rivets. It is protected on the back-haul by heavy runners. Three separate clevises allow a choice of either crotch chain or single line connection for the back-haul. The new scraper is said by the manufacturer to have a high degree of stability in operation. It comes in three sizes: 30-in., 36-in., and 42-in. These have rated capacities of 8, 12, and 16 cu. ft. respectively.

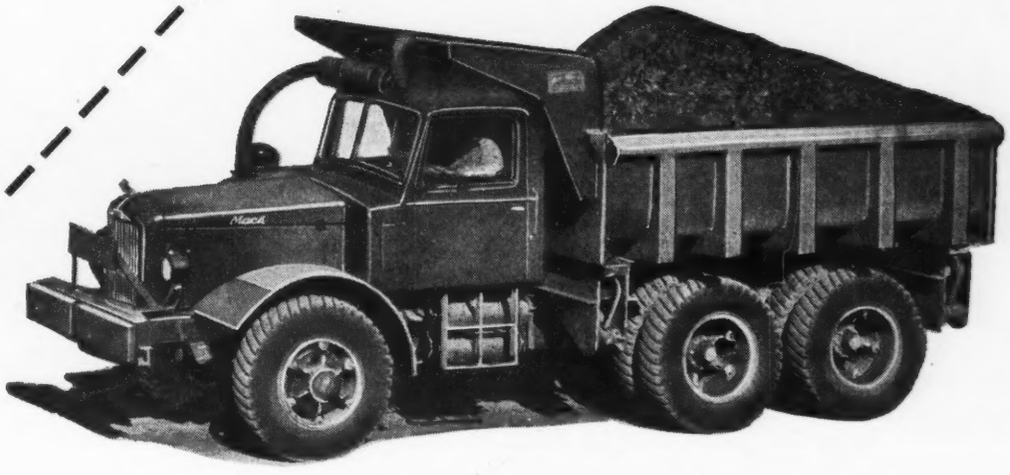


VOLTAGE TESTER eliminates possibility of error and danger in use. A solenoid indicator and a neon test lamp give results independently of each other. It is made by Ideal Industries, Inc., 5102 Park Ave., Sycamore, Ill.

Single-Phase Motor

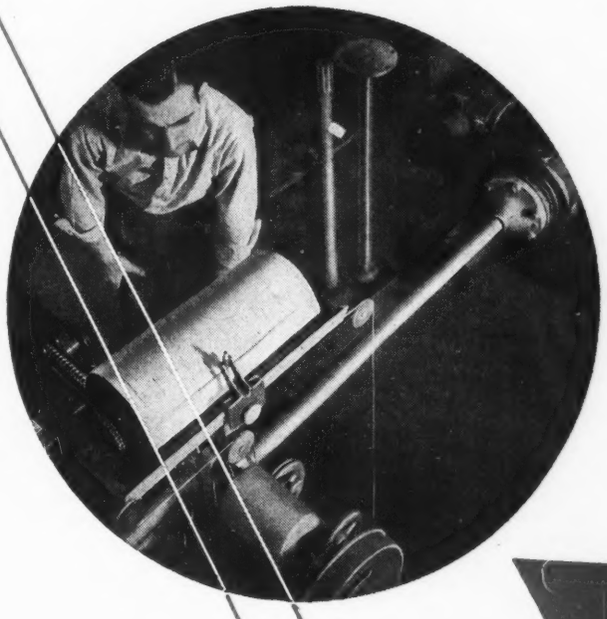
Westinghouse Electric Corporation, Pittsburgh 30, Pa., announces a new line of single-phase, squirrel-cage induction motors that use the new ideas that went into the Life-Line polyphase induction motors announced

you get more work out of Mack Trucks



There's good reason why you find so many hard-working Mack dump trucks engaged in open-pit mining. Profit-wise mining men know that the true measure of a truck is the way it pays off—in work. They know, too, that when it comes to working harder and lasting longer . . . at lowest cost — there's nothing on wheels to beat a Mack.

because..we put more work into Macks



There is no guesswork about the stamina of Mack parts. This testing machine determines the strength and elasticity of Mack axle shafts by imposing measured torque up to point of fracture. Sample shafts are tested to destruction, thus insuring that all Mack shafts fully measure up to Mack's exacting standards.

Mack

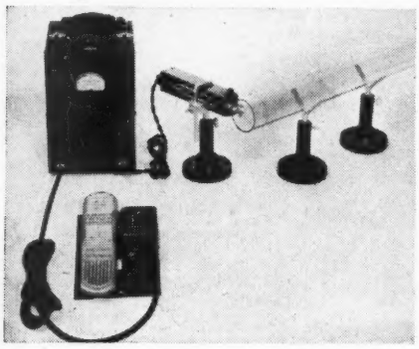
trucks for every purpose

Mack Trucks, Inc., Empire State Building, New York 1, New York. Factories at Allentown, Pa.; Plainfield, N. J.; New Brunswick, N. J.; Long Island City, N. Y. Factory branches and dealers in all principal cities for service and parts. In Canada, Mack Trucks of Canada, Ltd.

6218

SINCE 1900, AMERICA'S HARDEST-WORKING TRUCK

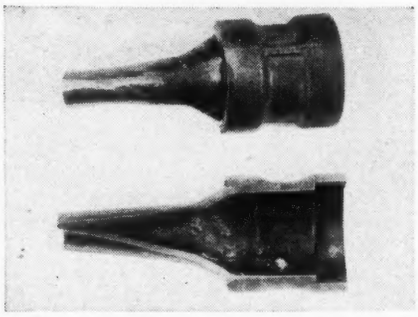
last year by Westinghouse. These new capacitor-start motors therefore benefit from the precision tooling, the standardized parts, and the high production methods developed for the three-phase motor. Compared with former models, this new single-phase motor is sturdier, its windings are more rugged, and its bearings are pre-lubricated, requiring no attention for at least five years. For full details, write to Westinghouse directly.



GLASS CUTTER for laboratory and plant use will make a clean, quick cut of glass tubing in any size up to 7½-in. O. D. Tubing can be cut in any position, either isolated or as an integral part of apparatus already set up. The special power unit indicates the exact cutting current necessary for each diameter of tube cut. Write Eberbach & Son Co., Ann Arbor, Mich.

Light-Weight Safety Goggle

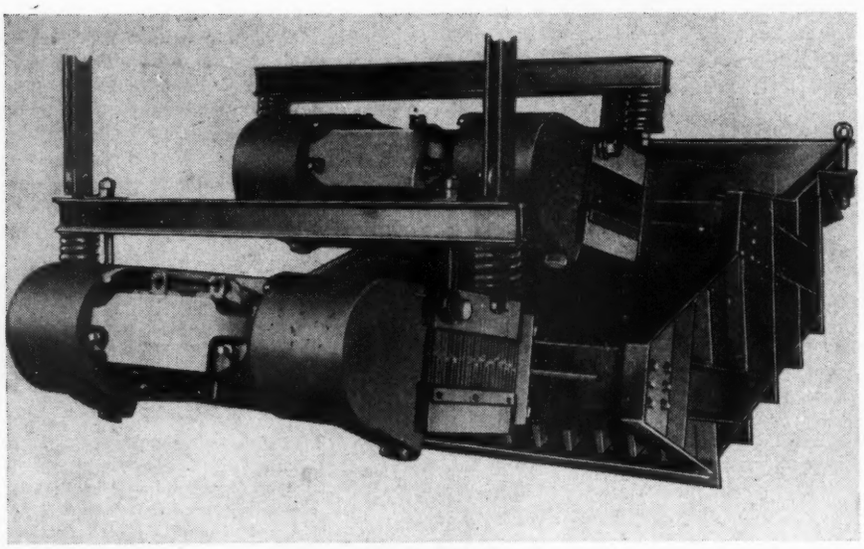
An all-plastic frame with a single plastic acetate lens features the new light-weight safety goggle now being made by American Optical Co., Southbridge, Mass. This AO-607 goggle is suggested for wearing as eye protection in machine work, hand tool operations, and in chemical and physical laboratories. It can be worn over spectacles.



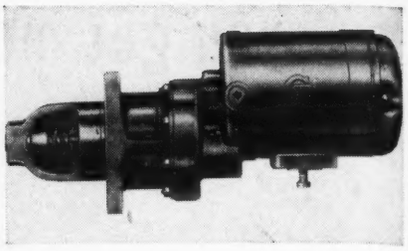
FLAGG-FLOW threadless malleable iron pipe fittings simplify pipe installations. Using a silver brazing alloy, the joint is made by simply heating the fitting until the flux bubbles. The lower picture shows a section of a joint. The pipe in this specimen failed at 65,000 psi., but the joint held.

Carbon Monoxide Tester

Using indicator tubes developed by the Bureau of Standards, a device for detecting dangerous concentrations of carbon monoxide in mine atmosphere is now offered by Mine Safety Appliances Co., Pittsburgh 8, Pa. In use, a detector tube is broken at the ends by a special device, then inserted in a tube holder. A sample of air is drawn through the tube by squeezing a bulb on the holder, and a color change in the silica gel in the tube indicates presence of CO. The depth of color shows CO concentration.



FEEDER-GRIZZLY for heavy-duty service is latest addition to line of vibrating feeders for crushers made by Syntron Company, Homer City, Pa. All models feature variable control of feed rate and full or partial grizzly decks.



Diesel Engine Starter

Compressed air starting for diesel engines on mine locomotives is available through a new air starter recently announced by Chicago Pneumatic Tool Co., 6 East 44th St., New York 17, N. Y.

The starter is a 7-hp. air motor with a Bendix starting drive. It mounts on any diesel, and is powered from a 30- to 40-gal. air tank, which is charged beforehand from the mine's compressed air system. This air starter automatically meets all mine safety requirements.

INDUSTRIAL NOTES

Alan P. Schreiber will have charge of sales contacts with the chemical and metallurgical industries for the equipment and radioactive products of **Tracerlab, Inc.**, Boston, Mass.

The Du Pont Co., Wilmington, Del., announces the promotion of **Harry F. Brown** to general manager of its explosives department and of **Samuel G. Baker** to general manager of the electrochemicals department. **Philip J. Kimball** becomes assistant to Mr. Brown.

Montana Mining and Engineering Co., Philipsburg, Montana, announces opening of an office for consulting work on any phase of mining or milling activity. **W. L. Degenhart** will handle milling; **F. S. Neal**, geology; **Robert Franz**, mining; **E. T. Irvine**, legal matters.

R. E. Keidel has joined the staff of **Euclid Road Machinery Co.** as assistant advertising manager.

Smith Engineering Works, Milwaukee, Wis., has appointed **Sam A. Madrid** as western representative for Telsmith mining equipment. He will cover all the states west of, and including, Montana, Wyoming, Colorado, and New Mexico.

Arthur B. Morse has been named vice president and assistant director of sales of **Laclede-Christy Clay Products Co.**, St. Louis, Mo.

Nordberg Manufacturing Co., Milwaukee, Wis., announces the appointment of **Howard L. Phillips** as assistant export manager, and of **H. M. Cahill** as sales manager of the small engine department.

Western-Knapp Engineering Division of Western Machinery Co. has opened a new office in the Power Bldg., Hibbing, Minn.

Introducing Columbia's MODEL "A" SLUSHING SCRAPER

CAST IN ONE PIECE
from High-Test Manganese Steel

This one-piece casting of long-wearing manganese is the result of Columbia's new foundry technique. The replaceable shoe is mounted by two bolts, the only two used in the entire scraper, while the cutting blade is attached by countersunk rivets. On the back-haul, body and blade are protected from wear by three runners cast as an integral part of the scraper. Available in 30-, 36- and 42-inch sizes.

This familiar trade mark appears on every Columbia Casting. It is our stamp of inspection and your assurance of uniformly high quality.

Columbia
STEEL CASTING CO., INC.
PORTLAND 9, OREGON

MODEL "A" FEATURES

- All-Manganese Casting
- Perfectly Balanced
- Fills to Capacity
- High Stability Factor
- 3 Back-Haul Clevis Brackets
- Webbed, Braced Construction

SPECIFICATION FOLDER AVAILABLE

WRITE TODAY

COLUMBIA STEEL CASTING CO.
933 N.W. Johnson Street
Portland 9, Oregon

Please send me without obligation complete information on your new slushing scraper.

Name_____

Firm Name_____

Address_____

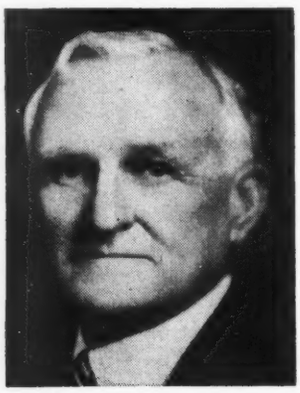
City_____ State_____

Export purchases, except Alaska, may be made only from: MARSMAN CO. of CALIFORNIA, SAN FRANCISCO 4, CALIF., Cable Address "MARSCALIF" Inquiries regarding such purchases should be made to that company

GRIZZLY BARS, SHEAVES, CAR WHEELS, MUCKING MACHINE WHEELS, BUCKET TEETH

PERSONAL NEWS

Donald B. Gillies, who recently celebrated his 75th birthday, has resigned as vice president and director of Republic Steel Corporation, Cleveland, Ohio, in order to lighten his responsibilities. He will remain with the company as an advisor and consultant on mining. Internationally known as



DONALD B. GILLIES

an authority on mining, Mr. Gillies is a past president of the American Institute of Mining and Metallurgical Engineers (1939), and was recently elected president of the Lake Superior Iron Ore Association.

J. A. Furiak, formerly on the exploration staff of Privateer Mine, Ltd., has been appointed assistant engineer for the municipality of Surrey, with offices in the Municipal Hall, Cloverdale, B. C.

W. G. Jewitt has been appointed manager of mines for Consolidated Mining and Smelting Company of Canada, Ltd. In his new post Mr. Jewitt will be in charge of all the company's mining and milling operations and exploration activities. He is a graduate of the University of Alberta and joined the company's mines department in 1927.

Frank S. Willis has retired as superintendent of the zinc plant of the Trail smelter, Consolidated Mining & Smelting Company of Canada, Ltd. He has been succeeded by **T. H. Weldon,** formerly assistant superintendent.

Frank A. Forward, head of the department of mining and metallurgy, University of British Columbia, has been elected president of the Association of Professional Engineers of B.C.

C. P. Browning has announced his intended retirement as general manager of Britannia Mining and Smelting Co., Ltd.

Stuart H. Ingram has been elected chairman of the Southern California section, American Institute of Mining and Metallurgical Engineers. **Dr. Ian Campbell** of Caltech was elected vice-chairman for mining. The metals group elected **W. A. Saylor** as chairman and **M. K. Drury** as vice-chairman.

Joel M. Bowlby, president of the Eagle-Picher Company of Cincinnati, Ohio, has been elected to the board of directors of the Federal Reserve Bank of Cleveland.

Mrs. Margaret Orr, assistant secretary-treasurer of Northwest Mining Association since 1925, retired Jan. 1. Prior to joining the Association, Mrs. Orr worked for "Mining Truth," a publication.

Roy M. Hammond and **Walter F. Everly,** Butte mining engineers who have been associated with the Richard McCarthy assay office for the past 18 months, are now carrying on a consulting engineering practice in conjunction with the assay work.

Tom G. Murdock, of Raleigh, N. C., assistant state geologist for the State of North Carolina, has resigned to accept an overseas position with the U. S. Department of State.

W. W. Mein, Jr., vice president, Calaveras Cement Co., San Francisco, has been elected chairman of the San Francisco Section, A.I.M.M.E. Other officers elected include **E. H. Wisser,** vice chairman; and **George H. Playter,** secretary-treasurer. Members of the executive committee are **L. B. Wright, P. R. Bradley, Jr., Dr. Carlton D. Hulin, William C. Collyer.**

H. J. Fraser has been appointed general manager and assistant to the president of Falconbridge Nickel Mines, Ltd. Mr. Fraser has been manager of the company's mining operations in the Sudbury, Ont., area since July, 1945.

Kurt Spohr has joined the Ore Division, Philipp Brothers, Inc., New York. Mr. Spohr was previously connected with the Ore & Chemical Corporation, New York, for over 20 years.

Howard Kegley has been elected president of the Mining Association of the Southwest. Other officers elected for the 1948 term include **H. W. Howe,** vice president; **John Herman,** second vice president; **Victor J. Hayek,** secretary.

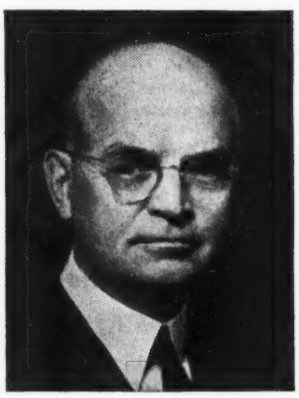
O. H. Woodward retired in October from the position of general manager of North Broken Hill, Ltd., N.S.W., after 13 years in that capacity. He will continue as a member of the company's board of directors. **Dr. M. D. Garretty,** formerly consulting geologist to the North Broken Hill, has rejoined the firm as chief geologist and is directing an extensive exploration program in a search for new ore deposits. **A. R. West,** formerly underground manager, has been appointed manager.

Harold M. Wright and **Leonard F. Wright,** both graduates in metallurgy of the University of British Columbia and the University of Utah, have formed the partnership of Wright Brothers, metallurgical engineers, with offices in the Credit Foncier Bldg., Vancouver, B. C.

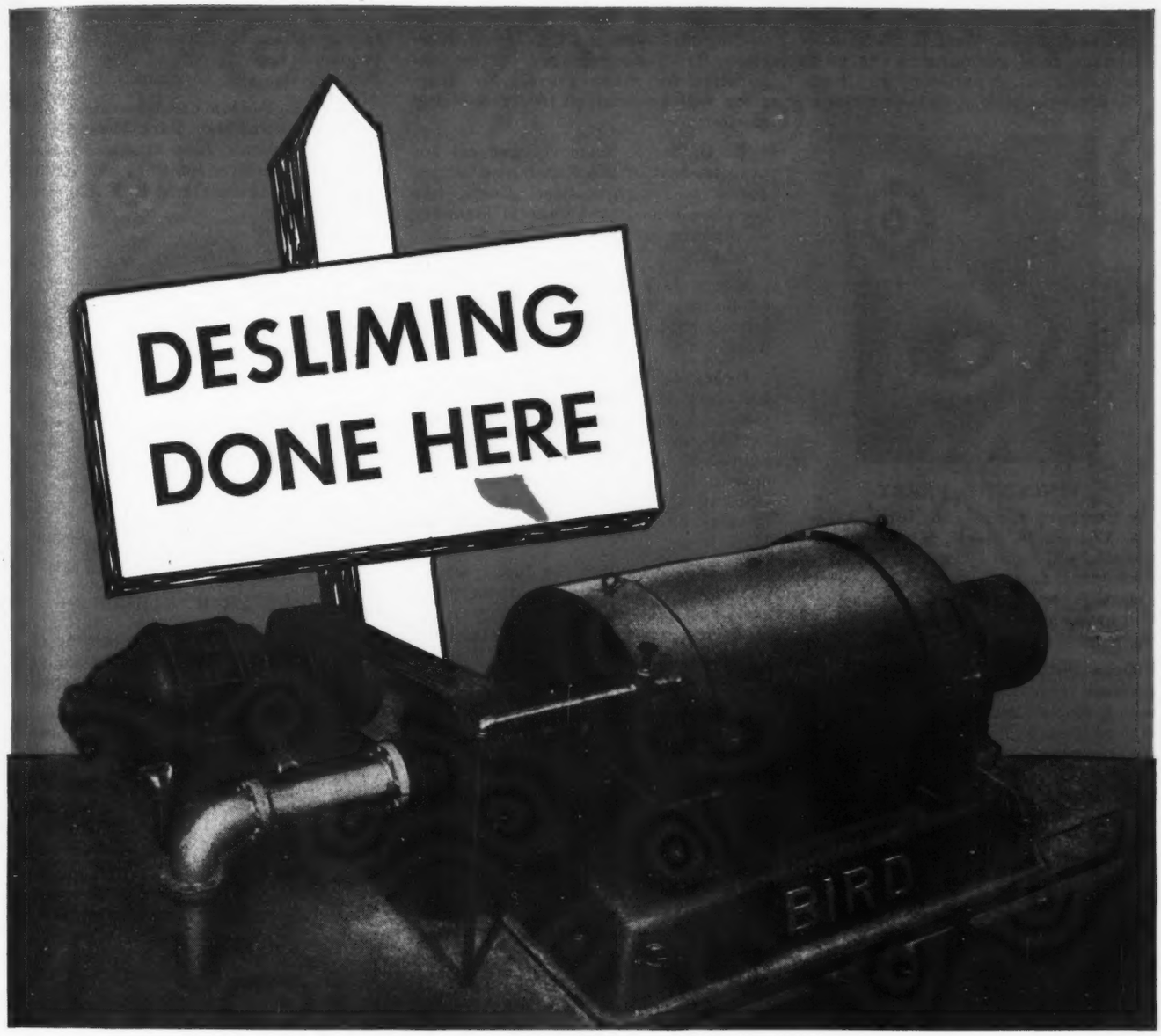
E. W. Whitman, who for the past two years has been assistant superintendent of the Inland Steel Co.'s Morris Mine in Ishpeming, Mich., has been promoted to superintendent of that operation. A graduate of the Michigan College of Mining and Technology, Mr. Whitman has been with Inland since 1942. After serving as engineer at the Greenwood Mine in Ishpeming and at the Sherwood Mine in Iron River, he was made assistant superintendent of the Morris Mine early in 1946. **John H. Strome** has been promoted to safety director for the iron ore and limestone operations of the company, succeeding **W. T. McCormick,** who will devote the majority of his time to his duties as supervisor of occupational hygiene, with headquarters at Indiana Harbor, Indiana.

James Ivers, vice president and general manager, Silver King Coalition Mines Co., has been elected president of the Utah Mining Association for 1948. **A. G. Mackenzie** will be vice president; **W. H. H. Cranmer** 2nd vice president; **Paul H. Hunt** 3rd vice president; and **J. K. Richardson** continues as manager of the Association, whose annual meeting was held in Salt Lake City December 15.

Reno H. Sales has retired from active duty as chief geologist of Anaconda Copper Mining Co. He will be retained by the Company as consulting geologist, devoting his time to investigation and study of ore deposits. **Vincent D. Perry,** formerly assistant chief geologist in charge of outside exploration, succeeds Mr.



RENO H. SALES



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Sales and will have headquarters in New York City. **Murl H. Gidel**, now assistant chief geologist in charge of the geological department in Butte, will supervise geological work in all

VINCENT D. PERRY

the Company's mines in North America. **Chester H. Steele**, Mr. Gidel's assistant, will be in charge of the Butte geological department. **Alex McDonald**, who was Mr. Perry's assistant, will have charge of outside exploration work in Western United States.

Ocha Potter, superintendent of the Ahmeek mine, Calumet division, Calumet & Hecla Consolidated Copper Co., retired Dec. 31. He will continue in the company's employ as consultant. **O. A. Rockwell**, with the company since 1943, has been made mining manager and will be responsible for planning and supervision of all surface and underground operations. **C. L. Fichtel**, who joined Calumet in 1901, has retired, but will retain a connection with the company as consultant. **H. C. Kenny**, formerly smelter superintendent, has been made smelter and chemical manager and will supervise the company's smelter and chemical operations and the preparation of leaching of secondary copper. **Robert McIntosh** has retired as mechanical superintendent after 46 years' service. He will be retained as a consultant.

C. P. Girdwood, formerly chief engineer of Dome Mines, Ontario, has been appointed superintendent, succeeding W. H. Johns, who died recently. **D. E. Howard**, previously ventilation engineer, has been made chief engineer.

Donald B. Angus, formerly mine superintendent for Central Patricia Gold Mines, Ontario, will succeed **Richard E. Barrett** as manager, as the latter assumes a professorship of mining engineering at the University of Toronto. **T. T. Tiggert** has been appointed assistant manager and mine superintendent and will be in charge of mining operations. **Eric Marchbank** has been named mine captain.

J. V. Reynolds of Joplin, Mo., vice president and manager of the Century Lead and Zinc Co., has assumed active management of the Royal mine properties and mill of United Zinc Smelting Corp. in the Picher mining field, succeeding **D. G. Harrison**, Tri-State manager of the corporation for many years. Mr. Harrison will be retained in a consulting capacity.

H. D. Stark, formerly general superintendent of the Pittsburgh works, Jones & Laughlin Steel Corp., has been made assistant general manager of manufacturing operations for that company.

Harry J. Wolf has joined the firm of Behre, Dolbear & Co., consulting mining engineers and geologists, New York City.

Henry L. Pierson has been elected secretary of Freeport Sulphur Company. A graduate of Princeton University and the Columbia University School of Law, Mr. Pierson has been assistant secretary of the company since 1939, except for two years when he was on leave to serve with the U. S. Army.

R. L. Kidd has left for Japan, where he will serve as principal technical expert on nonferrous metallurgy under the direction of the head, Metallurgy Branch, Mining and Geology Division, Natural Resources Section, U. S. Government. He will conduct field examinations, investigations and inspections of Japanese nonferrous metallurgical plants; prepare reports on production, development of new techniques and practices; and collect data on operation of plants in territories formerly occupied by Japan.

MURL H. GIDEL

C. E. Weed has been made president of the new Amico Mining Corp., organized last year by Anaconda Copper Mining Co., Miami Copper Co., and Inspiration Consolidated Copper Co. The new company will engage in exploration of undeveloped mining properties in the Globe-Miami district of Arizona. Mr. Weed is also vice president in charge of mining operations for Anaconda Copper. **E. L. Rossin**, vice president of Miami Copper, was appointed vice president of the new company and **W. D. Thornton** and **R. S. Newlin**, of Anaconda and **M. A. Caine**, vice president of the Tennessee Corp., are directors for Amico.

G. A. Cowan has been appointed sales manager of the new Celatom products department of the Eagle-Picher Sales Co., Cincinnati, Ohio.

Clark L. Wilson has been made superintendent of New Park Mining Co., Park City, Utah. **John H. Cone** is assistant superintendent; **F. A. Kuhlman**, mine engineer, and **R. E. Gilbert**, geologist.

CHESTER H. STEELE

T. S. Davey, consulting engineer of Grass Valley, Calif., is in charge of the development of the HPH group at Nahwitti lake, Vancouver Island.

Robert Fee resigned recently as assistant mine manager of Discovery Yellowknife Mines, Ltd., and is now living in British Columbia.

Gavin A. Dirom has been transferred to the Salt Lake City office of American Smelting and Refining Co.

J. B. Watson, for the past several years purchasing agent at Vancouver, B. C., for Premier Gold Mining Co., Ltd., has left for Buchans, Newfoundland, to join Buchans Mining Co., Ltd., a subsidiary of American Smelting & Refining Co., as business manager.

Dr. H. C. Gunning, who resigned recently as professor of economic geology at the University of British Columbia, has opened offices as consulting geologist in the Yorkshire Bldg., Vancouver, B. C.

Felix S. Cohen has resigned as associate solicitor of the U. S. Department of the Interior to become associated with Yale Law School and the College of the City of New York.

Guy Riddell is in Korea as mining advisor to the U. S. Military Government. His headquarters are at Seoul, and he may be addressed as follows: APO 235-2, DAC ASAMGIK, National Economic Board, % P. M., San Francisco.

Glenville A. Collins, consulting mining engineer, who has had offices in Vancouver, B. C., and Portland, Ore., has closed his Portland office and opened a new office at Santa Barbara, Calif. Mr. Collins is president of North American Goldfields, Ltd., which operates two dredges in the Cariboo of Britsh Columbia, and is building another dredge on Peters Creek near Barkerville, B. C. During

the past month, he has been in Colombia, South America, inspecting properties near Pato and on the Nechi and Amaceri Rivers where hydraulic operations are being started by the Amaceri Mining Co., with **George A. Ball** as manager of the operations. Mr. Ball was formerly with Pato Consolidated Dredging Co.

Frank R. Milliken, assistant plant manager of National Lead Company's MacIntyre Development, Tahawus, N. Y., has been appointed plant manager of that development, succeeding **Gloyd M. Wiles,** now chairman of the Company's mining committee, with headquarters in New York. Mr. Milliken was with Utah Copper Co. before joining National Lead in 1941. **Allan R. Reiser** will fill Mr. Milliken's former position at Tahawus. He was formerly general superintendent of Park City Consolidated Mines Co., Fredericktown, Mo.

Duncan E. Harrison has become general superintendent for the Vanadium Corporation of America at Naturita, Colo. He was formerly in business in Denver.

OBITUARIES

Arthur P. Van Gelder, 74, widely known in the American explosives industry, died Dec. 10 at the Delaware Hospital, Wilmington. When he retired from active service in the explosives industry in 1921, Mr. Van Gelder was general superintendent of high explosives of Hercules Powder Company. He was co-author with Hugo Schlatter of the "History of the Explosives Industry in America," considered to be the authoritative volume on names, dates and places in the industry.

Isaac Elvin Mosher, 73, died recently in Toronto, Canada. Mr. Mosher had been actively associated with mining in Cobalt, Ont., for more than 40 years.

Douglass Hewitt Ferry, consulting mining engineer, died Nov. 25 in San Jose, Calif., aged 61.

Joseph E. Curry, one of the organizers of the Apache Powder Co. in Arizona, died at his home in Los Angeles recently. He was an official at one time of the Calumet and Arizona Mining Co., and of the New Cornelia Mining Co.

M. J. (Mike) Sullivan, 72, well known in Montana mining circles, passed away suddenly Dec. 27. Senator Sullivan, a member of the Montana legislature for many years, during which time he was on the mines and mining committee, was the owner and operator of Alhambra Hot Springs, between Butte and Helena.

P. H. Nelson, 74, of Duluth, Minn., died Nov. 9 in a Duluth hospital. Mr. Nelson was president of the Greenway Mining Co., Grand Rapids, Minn.

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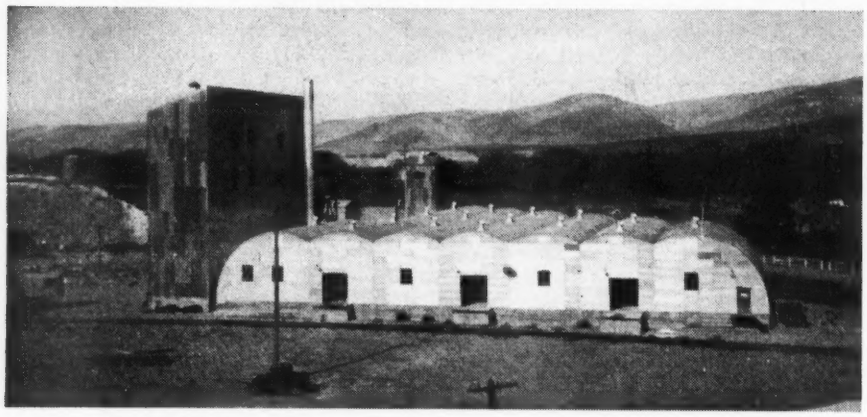
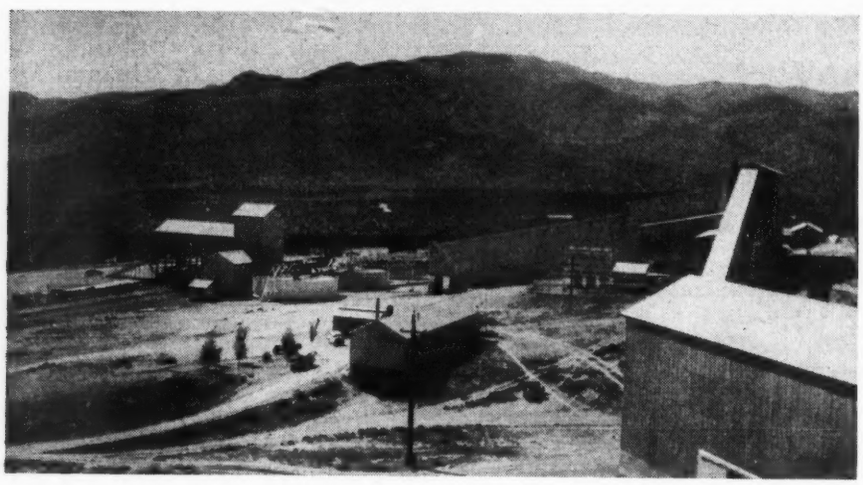
REGIONAL NEWS



NEW DIATOMACEOUS EARTH processing plant of the Eagle-Picher Co. Insulation Division near Clark, Nevada. Feed is mined from a quarry seven miles away.

COPPER CANYON MINE near Battle Mountain, Nevada. Mine surface plant and 350-ton concentrator are shown above.



NEW 100-TON CONCENTRATOR of Combined Metals Reduction Co., Pioche, Nev., Plant handles ores from Caselton, Ely-Valley, Prince and other properties.

NEVADA

Mountain City Copper liquidates assets—Riley tungsten mine closed "for the present"

★Stockholders of the Mountain City Copper Co., at a special meeting in San Francisco in late December, voted to dissolve the corporation under Utah laws and to liquidate and distribute all assets. The copper mine at Rio Tinto, Elko county, with 350-ton flotation mill has been closed since September.

★At the Getchell gold mine, a test plant housed in the 1,500-ton cyanide mill, was reported treating 100 tons per day in tests designed to eliminate primary ore roasting and to remove the arsenical sulphide by primary flotation. At the new three-compartment shaft, 3,000 ft. north of the open-cut workings, an electric hoist and steel headframe have been provided.

★The tungsten concentrator of the Nevada-Massachusetts Co. has been treating about 400 tons of scheelite per day, one-fifth from open cuts, the remainder from workings of four shafts extending to more than 1,100 ft. in depth. Smaller plants, operated during the war at Toulon and Golconda, remain closed.

★Reports from Pioche that district operators had decided to cut the miners' wage scale are denied in a statement by Samuel S. Arentz, superintendent for the Combined Metals Reduction Co., largest Nevada lead-zinc producer, operating a 1,500-ton selective-flotation mill at its Caselton mine.

★Con. Chollar, Gould & Savage Mining Co., operating open-cut gold mine and 400-ton cyanide mill at Gold Hill, on the Comstock lode, reported operating revenue of $76,105 for the third quarter of 1947. Thomas V. Barton is managing director.

★Copper Canyon Mining Co. has granted leases on its Contention, Carissa, Tomboy and other formerly productive mines in the Copper Basin area and has arranged to treat the product of lessees in its 400-ton flotation mill. The Tomboy is an open-cut copper-gold project.

★The Riley tungsten mine of the U. S. Vanadium Corporation in the Potosi district of Humboldt County is being closed down "for the present," it was announced by J. V. Horn, vice-president, in a recent statement.

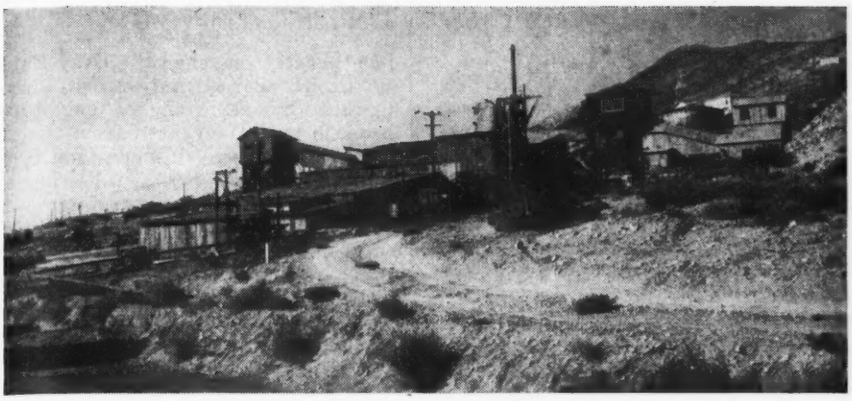
★Con. Eureka Mining Co., controlled by Utah operators, has undertaken development of its claims on Prospect Mountain, two miles west of Eureka and a mile south of Eureka Corporation, Ltd., property. Work will be conducted through the old Diamond tunnel and four shafts.

UTAH

Kalunite plant is sold to J. R. Simplot—Union locals move to secede from MMSW, CIO affiliation sought

★War Assets Administration sold the surplus Kalunite plant Dec. 31 to J. R. Simplot, Idaho industrialist and fertilizer manufacturer, at a price of $752,000.

Mr. Simplot raised his previous bid by $127,000 to meet the figure



DARWIN MINES of Anaconda Copper Mining Co., Darwin, California. Additional equipment is being installed at this 150-ton mill now handling oxide and sulphide lead ores to increase capacity to 250 tons per day.

proposed by American Potash & Chemical Co. Mr. Simplot, high bidder at an earlier bid opening, was awarded the plant on grounds that sale to him would aid small business. American Potash has protested the sale.

The new owner of the plant said he hoped to be producing ammonium sulphate within 60 days.

The plant will be used later for production of triple super-phosphate. For this he will obtain sulphuric acid, and phosphate rock from Utah and Idaho. American Smelting & Refining Co. has announced plans for increasing its output of sulphuric acid at Garfield by 150% at a capital investment cost of between $3,000,000 and $4,000,000. Westvaco Chlorine Products Co., of New York City, has announced plans to build a $3,800,000 electric furnace west of Pocatello, Idaho, in 1948 to produce elemental phosphorus.

★Demand for copper after the first half of 1948 will depend largely on success of the Marshall plan, E. T. Stannard, New York City, president of Kennecott Copper Corporation, said during a January visit to company properties in Utah. Production now is far above the prewar normal, he said. Reversing the normal demand, 60% of copper produced today is used for wire and 40% for brass. When the demand for wire in housing and for telephone service drops, the general copper market will decrease, he predicted.

He estimated the company's new electrified railroad for hauling ore from the Bingham mine to the mills will be in operation by March 1. The new Magna power plant should be completed within a month, he said.

★Two locals of the International Union of Mine, Mill & Smelter Workers, comprising workers in Uintah basin gilsonite mining properties, have seceded from MMSW because of dissatisfaction with leftist leadership of the international.

Both have written to the state CIO asking for affiliation with that body and one has taken steps to petition the National Labor Relations Board for a new bargaining election.

Arthur Ashby, international representative at Salt Lake City, went to Bonanza, Dec. 31, and attempted unsuccessfully to obtain records and funds of the first local which has a membership of 90. He said the locals no longer are bargaining agents for the men because the contracts were signed by the companies and the international union "for itself and on behalf of the locals." Union dues collected by the companies are in litigation.

Mr. Ashby said an amendment to the international constitution adopted by means of the recent referendum vote requires 100 days' notice before a local can take action legally to secede.

He admitted that if the locals press for a labor election the MMSW will lose since its officers have not filed anti-communist affidavits as required by the Taft-Hartley law. He said workers not affiliated with MMSW will be without effective bargaining power.

Another local previously affiliated with district No. 2, MMSW, located at Pioche, Nev., also has seceded. Larger locals comprising employees of Kennecott Copper Corporation and American Smelting & Refining Co. have been drawn into company "councils" formed to bargain on a nationwide basis with employers, thus further diminishing strength of the district union.

CALIFORNIA

Large perlite deposit discovered in Napa County—Argonaut Mining Co. dissolves corporation

★Harvey Crawford has leased the Union smelter at Mojave, Kern County, from I. Blum, owner, and is adding furnace and roasting equipment to handle custom smelting of lead-silver, copper-silver-gold, and sulphide ores.

★North Star Placer Development Co.

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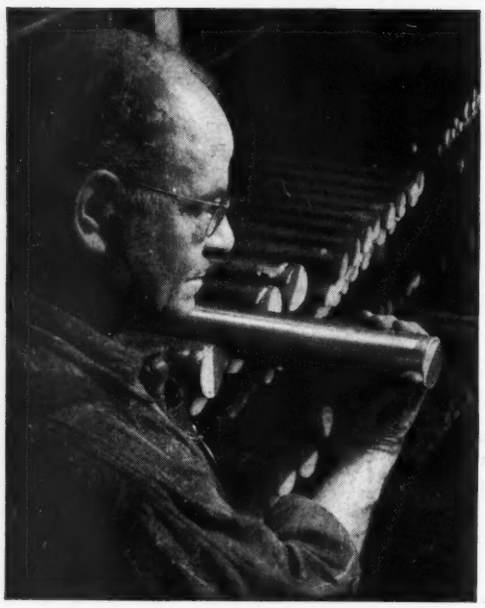

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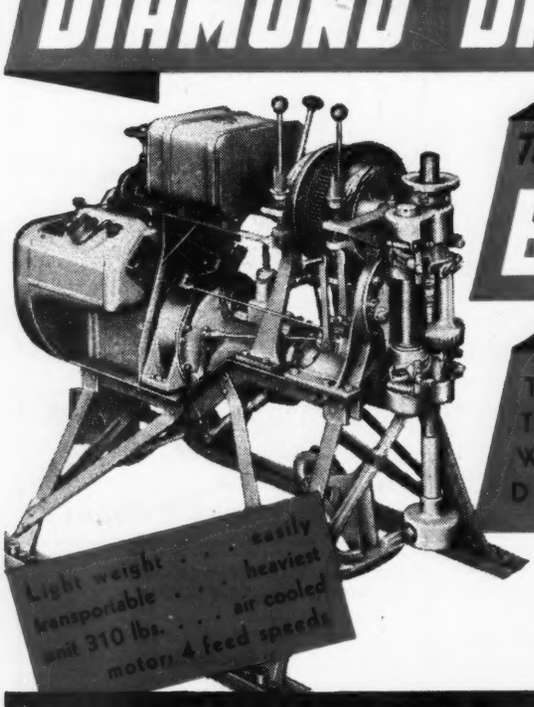

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California *(Continued)*

has recently reopened the Grey Eagle drift mine near Spring Garden, Placer County, and reports good gold prospects in raises advanced from the old adit workings driven more than 6,000 ft. by former operators, following an intervolcanic gravel channel some 4,000 ft. J. E. Schutte is president of the company, and Walter B. Martin, superintendent.

★Discovery of a large deposit of perlite in Napa County was announced by Olaf P. Jenkins, chief of the State Division of Mines. The discovery was made by Prof. N. L. Taliaferro and assistants, who have been mapping St. Helena quadrangle in cooperation with the State Division of Mines. The deposits, occurring in volcanic flows, range in thickness from several feet in the southern end to several hundred feet at the northern end. Location is about two miles east of the railroad station at Rutherford and 60 miles north of San Francisco.

★Hard Cash Gold Mining Co., Judge A. A. Turner, president, is sinking a shaft on ground purchased recently from the Yellow Aster Mining and Milling Co. as a preliminary to exploration. The property is in Kern County, just west of the summit on the Randsburg-Red Mountain road. A. F. Smith and Tweed Twitchie are sinking the shaft.

★Directors of the Argonaut Mining Co. voted recently to dissolve the corporation which has operated the Argonaut mine at Jackson, Amador County, since 1893.

Joseph B. Smith, secretary, stated the dissolution plan will be submitted to stockholders at a meeting which has not yet been called.

Reasons for the directors' action given by Mr. Smith were "impossibility of resuming mining operations in the foreseeable future, general economic conditions, and the present price of gold."

NEW MEXICO

Potash companies announce large expansion programs — New activity planned in Las Animas area

★G. R. Crager, president and general manager of the Empire Mining and Milling Co., Inc., reports that an extensive development program is under way in the Las Animas mining district at Hillsboro. The Empire company owns the Empire, Snake, Opportunity, Mary Richmond, Mamie C, and El Oro properties which are composed of approximately 100 claims. Plans for the future include the erection of a 100-ton mill and a 500-ton crusher on the Empire group to treat the ore from the other proper-

ties mentioned above. Company officials report that sufficient ore reserves are indicated to justify the ultimate expansion of the initial milling and crushing plant to 2,000 tons per day.

Small shipments of high-grade ore are being made now from the properties as development work progresses. Plans call for a 1,000-ft. shaft on the Empire property from which main mining operations will probably be carried on. An aerial tram will convey ore from the Eureka vein on the Snake property to the mill about two miles away. Mine dumps in the district also contain good milling ore which will be handled in the first unit of the mill.

Equipment purchased and delivered includes four compressors, four hoists, a new diamond drill, an industrial engine, and other small mining equipment.

★The American mine at Hachita, Grant County, an old lead-silver property, is being readied for examination and possible re-opening, according to Andrew B. Stewart and associates. Unwatering of the mine will be necessary to permit examination. The property is owned by Mrs. Maud J. Fowles.

★International Minerals & Chemical Corporation announced that it will start construction early in 1948 on a new refinery at Carlsbad for the production of chemical-grade muriate of potash and improved grade of potassium sulphate. Refinement in the present plant will also be made, and will result in increased recovery and capacity for existing grade of potash salts. The new plant addition will cost more than $1,000,000. It will use a new and efficient process for the development of chemical grade potassium chloride and improved grade of potassium sulphate developed by International's research staff at Carlsbad. Preliminary design is being handled by Western-Knapp Engineering Co., of San Francisco.

★A $4,000,000 expansion program by the Potash Company of America, Carlsbad, was announced recently. The expenditure covers general plant expansion work, additional underground equipment, water development and the sinking of two new shafts at the mine. Contracts for all surface installations have been let to Stearns-Roger Manufacturing Co. E. J. Longyear Co. has contracted to sink the shafts.

★The Burro Chief mine and jig plant at Tyrone, producer of fluorspar since 1943 under lease from Phelps-Dodge Corporation by H. E. McCray, was closed Jan. 1.

★The Hopewell mining district in Rio Arriba County will be the center of mining activity in the spring of 1948, according to Rufus Little, president and general manager of New Mexico Mines, Inc. Plans are now complete for the development of six

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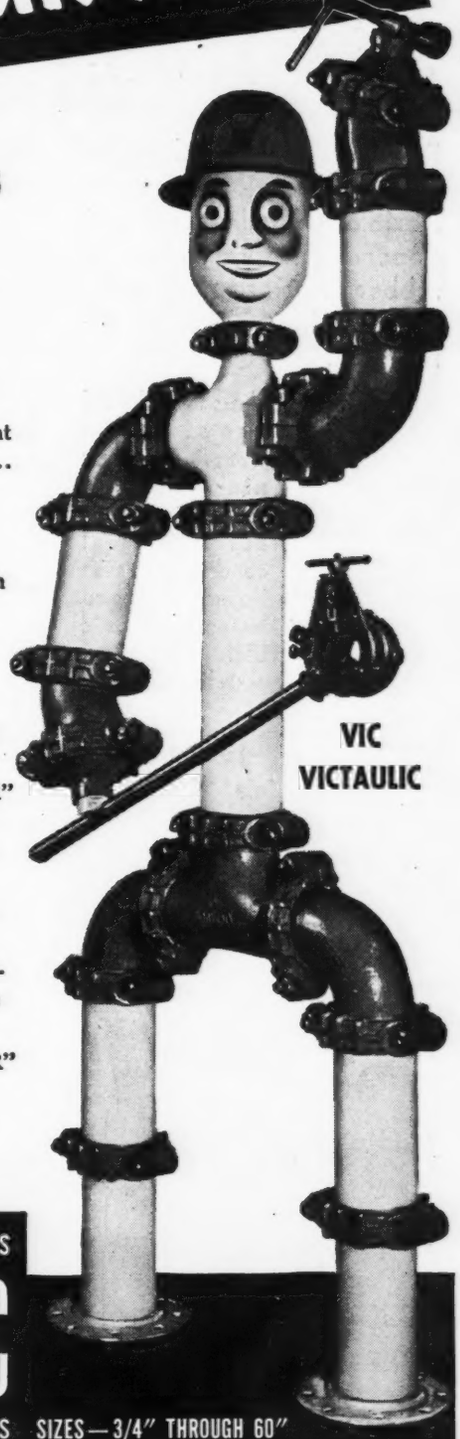

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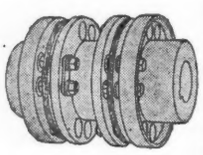

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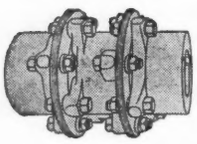

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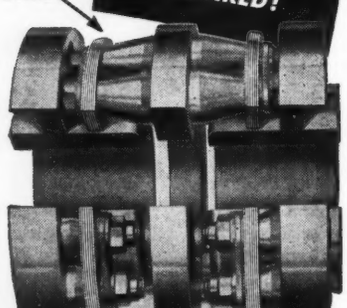

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THOMAS FLEXIBLE COUPLING CO.
WARREN, PENNSYLVANIA

New Mexico *(Continued)*

patented and five unpatented claims comprising 186 acres which include the Creasus mine and the Red Jacket property. The Creasus mine was a former gold and silver producer, and the Red Jacket, a gold producer with appreciable values in silver, copper, lead and zinc. New Mexico Mines, Inc., plans to sink shafts on each of these properties to depths of 125 ft. and 225 ft., respectively. A 30-ton mill will be installed if good ore is encountered.

★McDonald and Dodson, owners of the Nitt mine near Magdalena, resumed operations after a shut-down since June 30. A one-shift crew is producing ore that is predominantly zinc, with minor values of lead and silver, from a depth of 300 ft. below the collar of the Nitt shaft. Ore is shipped to the Peru Mining Co. mill near Deming.

ARIZONA

Orebody discovered at Jerome operations of Phelps-Dodge—Secondary lead smelter installed at Phoenix

★H. M. Lavender, vice-president and general manager of the Phelps-Dodge Corporation, discloses that a small mineralized area which is economically feasible to mine at present prices has been discovered about the 4,500-ft. level at Jerome. This discovery will extend the life of operations in Jerome from eight months to a year under present prices.

Mr. Lavender declined to describe the mineralized area as "an orebody" and added that it was found in a section where Phelps-Dodge has been prospecting for a number of years. The area contains mostly copper.

In 1945 the company announced that in a few years mining in Jerome would be stopped because of the lack of sufficient valuable orebodies. Since that time more than $1,000,000 has been spent on explorations in the lower levels.

★The Phelps-Dodge Corporation also announced the completion of its $2,100,000 electrification project at the Ajo open-pit operations where an additional $3,500,000 is being spent on modernization.

Mr. Lavender stated that the Ajo and Morenci properties are operating at capacity, but that production at Jerome and Bisbee fluctuates because of the shortage of underground miners.

Other activities announced by the company include a $2,500,000 addition to the Ajo power plant. With electrification of the Ajo open pit, this mine now becomes one of the most modern and third largest of all producers in the United States from the standpoint of ore handling. The company's Morenci mine ranks second, and handles approximately 50,000 tons daily. Ajo now handles 25,000 tons daily.

In addition to the mine improvement and the power plant which will be completed in 1949, the company is now constructing 51 new homes at Ajo for employees at a cost of $365,000 and a community theatre building. The total townsite improvements amount to about $800,000.

★Opening of the Dallas shaft at the Copper Queen marks a new step in the operation of this property. The modern concrete-lined shaft was completed shortly before the depression, but never placed in operation.

★The Department of Mineral Resources has advocated that regardless of the disposition of the Fort Huachuca military reservation the area be thrown open to mineral prospecting and entry. The recommendation was made in a letter to Robert O. Kelly, state surplus property purchasing agent. The University of Arizona and the State Game and Fish Commission are vying for control of the 76,000-acre reservation.

★The mining committee of the Phoenix Chamber of Commerce has recently published a booklet on mining activities in the state, and declares that only four percent of the state's 73,015,669 acres have been intensively prospected, and that perhaps less than one percent has been investigated by geophysical methods.

★Phelps-Dodge Corporation announces that a scrap brass sampling and handling plant is being constructed on a site near the company's Copper Queen smelter at Douglas. Construction and installation of machinery is expected to be completed within a few months.

★Directors of Tennessee Schuylkill Corporation, owners of the Tennessee mine at Chloride, Arizona, have announced the approval of a plan to acquire control of the Arizona Magma mine through the merger of the company and Great Western Exploration Co. Under this agreement two of the better known properties in this district, the Tennessee mine, a lead-zinc producer, and the Arizona Magma mine, which produces chiefly in gold and silver, will be united under one management.

★The Great Western Copper Co. has sold 22 patented mining claims in the Turquoise mining district near Courtland to John H. Betts of Long Beach, Calif.; the price was reported as $100,000.

★The newly organized Western Smelting and Refining Co. has installed a secondary lead smelter with daily capacity of about 35 tons at Phoenix. The company will produce soft lead and antimonial lead. Eighteen men are now employed in the operations. Company officials re-

veal that lead ore may also be treated in the near future.

★A 12,000-ft. pipe line to supply mill water has been installed at the French Lilly mine, near Cleator, by the Cedar-Talisman Co. The 2½-in. line will enable the mill to run 24 hours per day. Capacity of the mill is 60 tons. Water rights have been bought from the Golden Turkey mine.

★A Bureau of Mines report shows Arizona's output of "natural manganese" ore containing 35% or more of the alloy metal dropped to approximately 300 tons during the quarter just ended. The production of manganiferous iron and iron-bearing manganese also declined sharply. The report added that although large deposits of manganese are available in Arizona, they never were covered by subsidies and have been worked only slightly.

★Charles Willis, mining engineer and publisher of Phoenix, Arizona, was named by the National Mineral Advisory Council as a member of its copper committee. Willis was also appointed to one of six functional committees which will be formed later. The appointment was made December 12 at the Council's organization meeting at Washington, D. C.

★The War Department recently confirmed reports that a firm of New York engineers headed by Guy B. Panero, mining authority, is now studying abandoned Arizona metal workings for possible development of underground military installations.

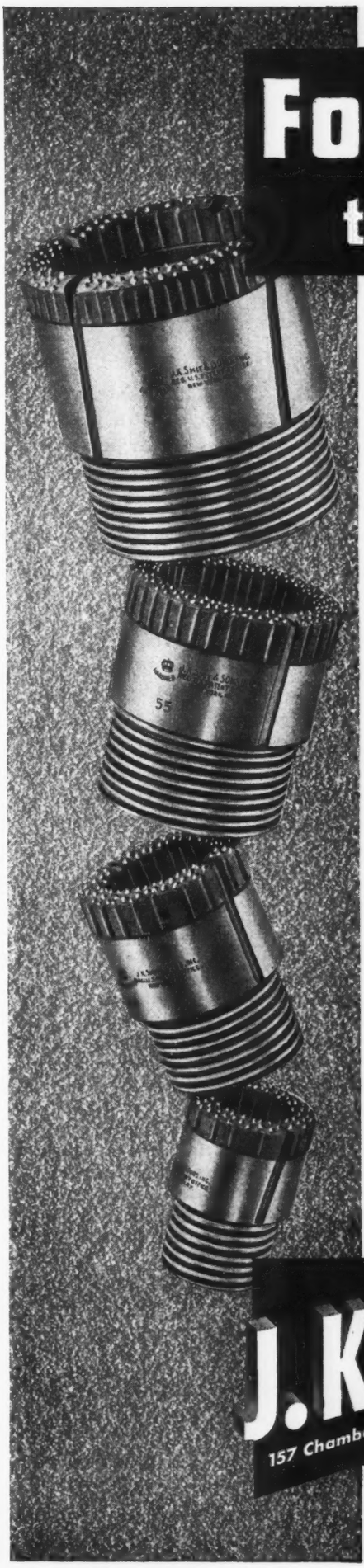
War Department sources added unofficially that the search is being conducted in co-ordination with the corps of engineers, and admitted that there is considerable activity in the neighborhood of Yuma.

COLORADO

Cresson mine cleans up 20 level to resume mining—State gold production increases

★El Paso Mines, Inc., in which International Mining Corporation of New York is interested, has suspended its operations at the El Paso Mine in the Cripple Creek district. A statement from Harvey L. Tedrow, general manager, gives the reasons for the shutdown as "the constantly increasing cost of operations and consequent reduction in the purchasing power of gold." About 40 men were employed on the property.

★Ollie E. Bannister and John L. Robinson, both of Grand Junction, and Alfred H. Bebee, of Colorado Springs, have been appointed to the State Metal Mining Fund by Governor Knous. Their terms will expire March 31, 1953. Charles N. Bell, of Ouray; Oscar Johnson, of Denver;



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A. **Yes . . . by the development on the part of Dixie engineers of a vastly improved crushing principle known as the Dixie Continuously Moving Breaker Plate.**

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Colorado (*Continued*)

W. E. Scott, Jr., of Central City; and John W. Valentine, of Boulder, all were reappointed to the State Mineral Resources Board until June 30, 1951.

★The Forest Queen mine, at Irwin in Gunnison County, is scheduled for steady production and milling this winter, says A. D. Hahn, superintendent. The first shipment of concentrates from the Queen was made in October to the American Smelting & Refining Co. smelter in Leadville and proved satisfactory.

★A night shift has been added at the Cresson mine, at Cripple Creek, to clean up the 20 level which is being prepared for mining. The water level is 15 ft. below the 20 level, which has been inactive since the pumps were removed in 1925. At present 25 groups of lessees are operating at the Cresson property, and 74 men are employed by the company.

★Three operating mills at Leadville are treating ore and handling old waste-ore dumps. The Leadville smelter of A. S. & R. Co. is working a full crew, and also making improvements. The two gold dredges operating on the Derry and Hayden ranches nine miles south of town are making regular gold output. A. S. & R. Co. is making regular shipments from its operation at Kokomo. The Webster interests are also making regular shipments of lead and zinc. Climax Molybdenum Co. has been doing deep diamond drilling on the south side of the Ten Mile fault on development work for lead and zinc. Two California gold dredging companies have options on the Kendrick and Williams placers. They expect to install bucketline dredges for deep operations and dragline dredges on the shallow ground.

★Colorado's gold production totaled 14,505 oz. in October, an increase of 339 oz. over the September output, according to the U. S. Bureau of Mines. The increase came from the Golden Cycle Corporation, in the Cripple Creek district.

★Lessees at the Silverton Mining Company's Mighty Monarch mine on Kendall Mountain near Silverton report having struck a vein about four to five feet wide with a fair grade of milling ore. A. G. Butler, who heads the Silverton company, said the ore contained lead, copper and tungsten and would probably show values in silver as well as gold. Storage facilities are now being erected to handle the ore.

★J. Don Alexander, president of the Alexite Engineering Division of Alexander Film Co., Colorado Springs, announces that after six years of mining and expanding vermiculite and perlite, his company has opened a perlite mine in southern Colorado containing several million tons of high-grade ore. "Peralex" is the trade name given to this ore and expanded

aggregate. Complete mining and milling equipment at the Peralex mine includes trucks with capacity to load 500 tons of ore per day on the cars at Texas Creek, Colorado. The ore is classified and ready for furnace expansion. Some ore is trucked to the Peralex furnaces in Colorado Springs, and some is shipped to perlite expanders east of the Rockies.

The Alexite Engineering Division has built a rotary expander that is still subject to improvement, but is turning out all sizes from fine powder to coarse concrete aggregate strong enough to answer building code requirements.

IDAHO

Westvaco company to produce elemental phosphorus — Ima tungsten mill destroyed by fire

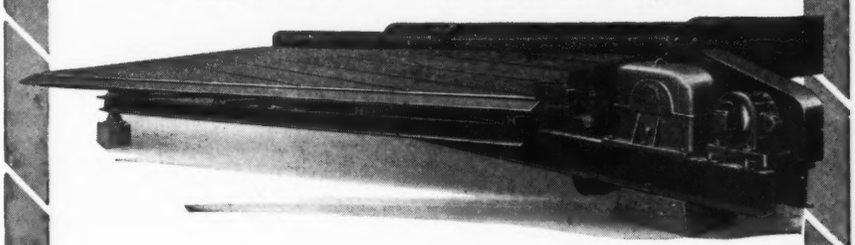
★The Westvaco Chlorine Products Co., of New York, has made arrangements to construct an experimental electric furnace on the Fort Hall Indian reservation near Pocatello, Idaho, to produce elemental phosphorus from phosphate rock. The project is on a 500-acre plot leased from J. R. Simplot, who has a phosphate fertilizer plant in operation and will use any surplus phosphorus produced. The Westvaco has awarded the Idaho Power Co. a contract to construct a power line to the site. Plant construction has been awarded to the United Engineers & Construction Co. of Philadelphia, and is expected to be completed and in operation in 1949. The plant is to be operated in connection with a sodium carbonate producer Westvaco is operating in Wyoming and the resulting product will receive final treatment at the company's plant at Carteret, N. J.

The Westvaco company has experimented with the Idaho phosphate rock in electric furnaces of the TVA Wilson Dam plant in Alabama and found it to be satisfactory to their needs. The initial Pocatello plant is said to be the forerunner of an installation involving several million dollars.

Idaho's extensive phosphate deposits, combined with cheap electric power, have attracted much attention since the Anaconda Copper Mining Co. established a phosphate mining camp at Conda, Idaho, several years ago and started shipping phosphate rock to the Anaconda smelter, where it was treated with sulphuric acid to become a commercial fertilizer. Since then the San Francisco Chemical Co. has entered the field with a big mining and processing enterprise at Montpelier, Idaho, and the Simplot company on the Fort Hall reservation.

The University of Idaho School of Mines has recently perfected a process for the treatment of low-grade phosphate rock that practically triples Idaho phosphate tonnage reserve.

AMAZING *SuperDuty* EFFICIENCY COMES FROM "PERFECT TEAMWORK"



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Idaho (*Continued*)

★Lucky Friday Mining Co., at Mullan, has started shipping a stockpile of silver-lead ore estimated to contain 3,000 tons to the Golconda custom mill. The ore has been mined during the past three months from stopes on the 1,400 level. The company is making preparations to start sinking to deeper levels.

★The Ima tungsten milling plant at Patterson, Idaho, was destroyed by fire of unknown origin early in December. The mine is owned by Ben R. Tillery and associates, of Twin Falls, and was under lease to the Bradley Mining Co., of Stibnite, Idaho. The mine and mill employed about 100 men. The Ima mine ore is a hübnerite and carries small quantities of lead and copper, which are saved as a by-product. It is understood that the Ima milling plant will be immediately replaced.

★Idaho is now the largest domestic antimony producer, accounting for 98% of the metal mined in the United States. The Coeur d'Alene district in Shoshone County and the Bradley Yellow Pine mine in Valley County are the principal producers.

★Leasers at the Silver Cable mine east of Mullan have shipped two consignments of ore to the Golconda custom mill since the Hecla Mining Co. surrended its lease on the mine.

★The Thomas Mines Corporation two-compartment shaft, on property adjoining the Dayrock mine in Nine Mile Canyon, is nearing its first objective, the 500 level, where the management plans to drive a crosscut to the vein system.

★George J. Neuerburg, instructor in the Department of Geology, University of Idaho School of Mines, has discovered the secret of obtaining optical figures from opaque minerals. Scientists have long used the petrographic microscope to study such figures in transparent minerals, and found this technique valuable in mineral identification. Mr. Neuerburg's discovery resulted from his search for optical figures in opaque minerals which he undertook during his studies for a master's degree at the University of California. He discovered the first optical figure in covellite. Dr. Vernon E. Scheid, head of the Department of Geology, predicts that these discoveries will open a new field of research in opaque minerals.

MONTANA

Mining activity in Virginia City area increases—U. S. Grant company installs machinery

★Green Mountain Mining Co., Dixon, Sanders County, is operating its mine one shift and its mill two shifts on ores containing copper, platinum, gold and silver, according to advices received from Earl F. Elstone, manager. At a recent meeting of directors, J. L. Richards, Polson, was elected president to succeed the late Harold A. Chambers of Hamilton. Tony Criswell, Missoula, was elected vice-president to succeed Mr. Richards.

★Considerable activity is reported in the Virginia City district, Madison County. The High Up mine, operated by John Phillips, has three tunnels opened and approximately 20,000 tons of gold-silver ore in sight. Phil Hatfield has been driving a crosscut to the ore in the Apex claim. Near Norris, on the east side of the Tobacco Root mountains, Boaz Mines, Inc., is doing some development work on the 265-ft. level under the direction of E. W. Stevens. W. T. Dunn, Spokane, is president of the company.

★In an address before the Madison County Mining Association, at Virginia City, W. R. Callaway, manager of the Victoria Mines, Inc., of Sheridan and Silver Star, stated that his company had just finished ten years of continuous operation. The first five years were devoted to the production of gold and silver until shut down by edict L-208. The company, of which John T. Potts, Salt Lake City, is president, in 1943 adapted its mill to flotation and took over operation of the Toledo mine and the Buckeye mine. Since 1943 about 150,000 tons of ore have been mined and milled with a production of some 7 million lb. of zinc and 3 million lb. of lead with accompanying gold and silver. The gross value of metals produced in the last five years amounted to about $1,400,000.

★U. S. Grant Mining Co., Virginia City, has installed machinery with a total value of $100,000 at its extensive operations and is shipping gold-silver ore at the rate of 350 tons a week, according to Walter H. Myers, president and general manager.

WASHINGTON

Bids submitted for Mead plant—New Jersey Zinc opens up regional office in Spokane

★Two contenders submitted bids for the lease of Spokane's $20,000,000 magnesium plant at Mead to the War Assets Administration office on Dec. 15. A joint bid was made by Pend Oreille Mines & Metals Co., and the Chromium Mining & Smelting Corporation of Ontario, Canada, Buffalo, N. Y., and Chicago. The other was submitted by Electro-Metallurgical Co. of New York, which built and operated the plant during the War.

★D. I. Hayes, manager of American Zinc's Western operation, said that crews at the Grandview mine in the

Metaline district had been nearly fully manned, and that production and development work had increased substantially since Nov. 1. A shortage of experienced workers continues, however.

★Litigation in the Merger Mines Corporation case ended recently by agreement. Morris Pearson accepted 65,000 shares of common stock as full payment for all his claims. The case had been contested in state and supreme courts of Idaho and Washington. The property lies in the Silver Belt of the Coeur d'Alene district.

★G. W. Heller has been granted permission to operate his pumice mine in Wenatchee National Forest by a Federal Court ruling which denied an injunction sought by the Federal Government on the grounds that the property jeopardized a recreational area by presenting unsightly pits resulting from mining operations.

★Northwest Gypsum Co. filed articles of incorporation at Olympia, Dec. 20, with capitalization of $250,000. Construction of a 150-ton plaster mill to cost $300,000 is planned at the company's property north of Huntington, Oregon, on the Snake River. It is in Washington County, Idaho. According to a company official, the gypsum deposit, running up to 98% calcium sulphate, is 100 ft. wide and three-quarters of a mile long.

★New Jersey Zinc Exploration Co. has opened the first regional office in the Pacific Northwest in the Metals Building in Spokane. E. P. Kaiser is in charge.

★The aluminum foil mill purchased by the H. J. Kaiser company will arrive from Teningen, Baden, in March, and will be in operation six months later according to J. R. Meek, works manager at the Trentwood aluminum rolling mill. Site of the mill installation is still unannounced.

★Rare Minerals Processing & Chemical Co., which is establishing its first metallic salts plant at Los Angeles, Calif., is considering the construction of a refining plant in the Spokane area for the treatment of tungsten, vanadium, manganese, and other ores, according to Jesse Villars, Spokane consulting engineer. Tungsten producers in Stevens County expressed the hope that a plant be located in the vicinity in order to bring the market for tungsten minerals closer to Spokane.

TRI-STATE

1947 zinc production declines, lead production up—Sucker Flats open-pit mine is shut down

★The year 1947 showed a decline of 19% in zinc concentrate shipments and a gain of 3.5% in deliveries of

Don't Let the "GRAY MARKET" ROB the Midwest and Southwest

[The shortage of nails and a prevalent "gray market" in this product are receiving much publicity.]

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There undoubtedly is a "gray market" on nails throughout the United States, but it is less prevalent in the Midwest and Southwest than elsewhere. To prevent the territory which we serve from contributing to this serious situation, we ask all of our customers ***not*** to sell nails at other than ***regular established prices.*** We implore users of nails in this area ***not*** to pay anyone more than ***legitimate established prices.*** Let's all do our part, by distributing nails wisely in our own territory. ***Don't let the "gray market" rob the Midwest and Southwest.***

***This policy applies to all Sheffield products, listed below.**

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Tri-State (*Continued*)

lead to smelters from the Tri-State mining district compared with the preceding year. The decrease in blende shipments may be laid to the discontinuance of the Premium Price Plan in mid-year. Only 67,134 tons of zinc concentrates were shipped during the last half of the year, a decline of 70,299 tons, or 49% in the shipment rate. Total shipments for the year were 204,567 tons, as compared with 252,512 tons in 1946. Because of the comparatively higher price for lead, galena deliveries for the first half were 17,062 tons and dropped to 13,100 tons for the last six months, for a total of 30,162 tons as against 29,137 tons in 1946. At the beginning of 1948, 18 mills and three tailing plants were operating as compared with 41 mills, of which 14 were tailing plants, a year ago.

★F. W. Evans, operator of the Sucker Flats open-pit mine, Webb City, reported recently that harassing damage suits had forced him to close his property. These suits alleged damage due to blasting during normal mining operations. Mr. Evans pointed out that he had been employing 40 men with an annual payroll of more than $100,000. Closing of the Waco mill was also announced by Mr. Evans. Loss of premiums was cited as an additional factor causing the shut-down.

★Crawford Brothers, of Seneca, and associates are developing a rich strike of lead and zinc in a shallow deposit through an old shaft reopened on the Crawford land, near Racine, south of Joplin. Jack Teague of Baxter Springs, acting deputy mine inspector in southeastern Kansas, is understood to have bought an interest in the partnership. The Crawford land adjoins the old Winchester lease. Some drilling was done on the Winchester land years ago by several companies, and in recent years by the Bureau of Mines, with reports of ore indications and cuttings at much deeper levels than the Crawford mine. Exploration work never was followed up by mine development.

IRON COUNTRY

C. & N. W. adds 30 ore pockets to No. 5 dock—Mather "B" shaft advances to 325-ft. depth.

★At Sault Ste. Marie, Ontario, an old sheet steel strip mill belonging to John Ludgate Associates of Pittsburgh, Pa., was recently sold to Portsmouth Steel Corporation. The plant has an annual capacity of 100,000 tons, and was reported to be sold for $275,000. It is being dismantled and moved to Portsmouth, O., to bolster the present inadequate production of the company plant there. The plant should be in operation by May 1.

★At Escanaba, Mich., the Chicago and Northwestern Railway Co. will construct 30 additional iron ore pockets to its No. 5 dock, to handle increased shipments from the Menominee and Marquette ranges. This will increase the dock to 218 pockets.

★H. S. Peterson, Ishpeming, Mich., general superintendent of Michigan ranges for Jones and Laughlin Co., was elected president of the Marquette Range Engineers Club for 1948.

★At a recent meeting of directors of Algoma Steel Corporation in Sault Ste. Marie, Ontario, Sir James Dunn, president, announced a $10,000 Christmas season gift to Sault Tech., a branch school of Michigan College of Mining and Technology at Houghton, Mich. This gift is in the form of scholarship fund for four boys at Sault Tech. for four years to be expended at the rate of $2,500 per year.

★Sinking of Mather "B" shaft by the Cleveland Cliffs Iron Co., Negaunee, Mich., is now in full operation. Weekly advance averages 25 ft. The present depth is 325 ft. Recently a second 400-hp. motor was added to the 12-ft dia. drum hoist used in the sinking operation. A 2½-yd. diesel shovel and two 10-yd. Euclid trucks are removing broken rock and gravel from the engine house site. Hand mucking is still used, but tests are being made with mechanical muckers.

MICHIGAN

Calumet & Hecla experiments with copper oxide as aid to plant growth in Florida

★Investigations sponsored by Calumet & Hecla Consolidated Copper Co. are in progress in Florida to determine the value of copper oxides for agricultural applications.

Dust mixtures containing copper oxide are being examined by the Potato Research Laboratory at Hastings; dusts, sprays and fertilizers by the Citrus Experiment Station, Lake Alfred; fertilizers and pasture treatments by the Everglades Experiment Station, Belle Glade; soil treatment at the Gainesville Station on grain crops, and fertilizer and pasture treatment by various independent growers and ranchers.

Copper is required for normal plant growth to provide adequate yields, and is essential to the production of grains, such as oats and barley. These grains do not ordinarily "head out" under growing conditions in Florida unless copper is added.

★Approximately $22,500 was distributed to Calumet division, C. & H. employees last payday in the form of a

dividend of $10 per employee. This was the fourth dividend distribution in 1947, each employee receiving a total of $30. The four dividends amounted to $68,000 at the Calumet division.

Calumet & Hecla's new tube mill at Decatur, Ala., costing approximately $8,500,000, will go into commission early this year and, according to E. R. Lovell, president, is expected to add materially to the company's earnings. These earnings will be used to repay a term bank loan of $6,000,000.

★The Department of Mining Engineering of the Michigan College of Technology at Houghton will offer a new degree, Bachelor of Mining Engineering, beginning with the 1948-49 academic year. The curriculum will require 15 terms, or quarters, for completion. Purpose of the degree, according to Professor J. Murray Riddell, head of the Department of Mining Engineering, is to offer the equivalent of a five-year course in mining engineering which will permit a broader scope in undergraduate study, and provide for the election of more courses in humanities, engineering administration, geology, mineral dressing, and metallurgy. Recipients of the B. Min. E. degree may receive the professional degree of E. M. two years after graduation upon approval by the faculty and upon submitting a report showing satisfactory accomplishment in the field.

The Lake Shore Engineering Co., of Iron Mountain, will provide a four-year scholarship in either mechanical or electrical engineering at the Michigan College of Technology, according to a recent announcement by Dr. Grover C. Dillman, president of the college. The total value of the scholarship is approximately $1,800.

TEXAS

★Southwestern Talc Corporation has been incorporated to conduct a mining business at Llano, 90 miles northwest of Austin. It is capitalized for $5,000 by Bertram Browne, J. B. Upton, and O. C. Behse.

★Mining, metallurgical, and geological courses at the University of Texas College of Mines, El Paso, have been fully approved by a national accrediting committee, university authorities announced recently.

★Mining activity in the vicinity of Terlingua, Tex., ceased with the halt of exploration work being carried on by Robert Pulliam. A crew of 20 men was employed in the search for cinnebar deposits. Messrs. Brown and Root had previously abandoned three workings in the area because of the low price of quicksilver.

★Incorporation of Cuesta Mines in

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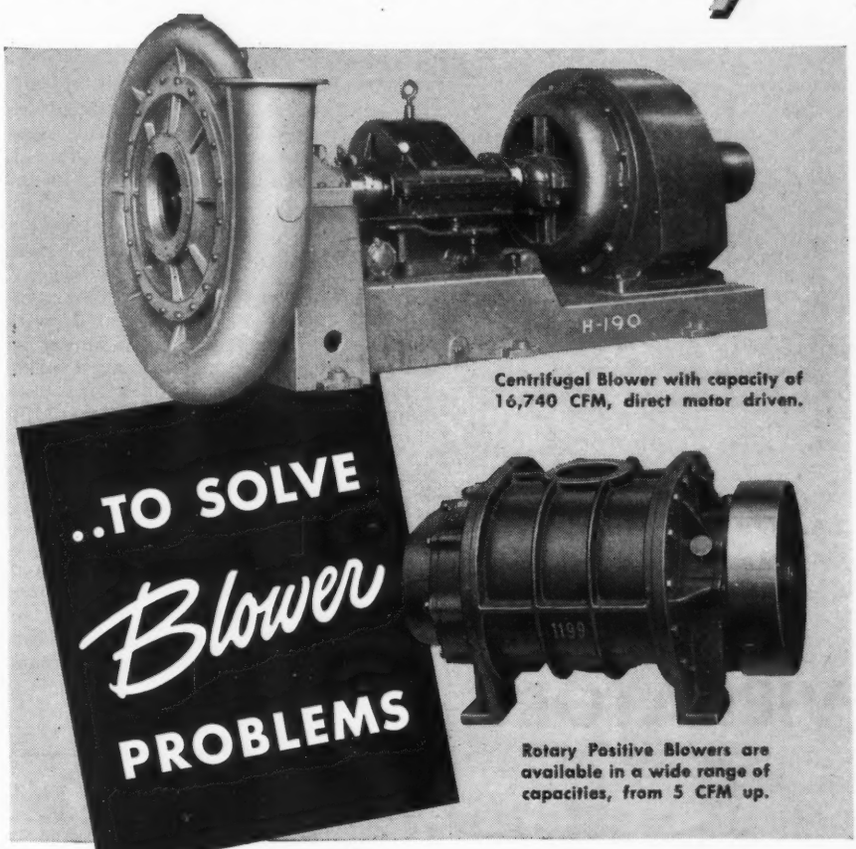

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Texas *(Continued)*

Houston was announced recently. The firm was incorporated by W. C. Burer, C. C. Calvin, and George E. Ross, with $1,000 capital stock.

ILLINOIS-KENTUCKY

★Transfer of fluorspar mining and milling properties of the Aluminum Ore Co., at Rosiclare, Ill., to the Alcoa Mining Co. became effective Jan. 1. Both companies are wholly-owned subsidiaries of the Aluminum Company of America. The Rosiclare operation will be known as "Alcoa Mining Co., Fluorspar Division." There will be no change in management or operating personnel with Walter S. Skeels, works manager at Rosiclare, continuing in charge. Allen B. Williams, of St. Louis, has been made a vice president of Alcoa Mining Co. in charge of fluorspar operations. Frank B. Cuff, of New York, is president. The Rosiclare property was purchased from the Fairview Mining Co. in October, 1924.

★Miles Haman, of Crystal Fluorspar Co., Elizabethtown, Ill., was appointed by Secretary Krug as a member of the newly organized National Minerals Advisory Council to represent the fluorspar industry.

NORTH CAROLINA

★Feldspar mining interests in North Carolina are confident that production will return to peak conditions as a result of continuing shortage of steel for containers. Packers will rely more upon glass for another year or two. This increase in demand for glass should promote feldspar production, since most of the state's output is on order from glass manufacturers.

FLORIDA

★Florida's mining industry is expected to show for 1947 a new all-time high in tonnage and in value, greatly exceeding the previous record production of about $30,000,000 in 1946. The importance of the state's mineral resources is being accorded greater recognition, with new companies doing exploration work on newly discovered deposits. In 1946 the combined production of land pebble, hard rock and colloidal phosphate reached a new peak of 5,005,511 long tons with a value in excess of $21,000,000, which exceeds the value in 1945 by $4,700,000. Limestone, kaolin, Fuller's earth and lime have been growing in volume during recent years.

CANADA

Nickel output increases—Saskatchewan announces program to aid miners —Plans made for C.I.M.M. Vancouver meeting

★Copper production in October, at 22,664 tons, was higher than for any previous month in 1947, as reported by the Dominion Bureau of Statistics. For the first ten months copper output amounted to 189,091 tons compared with 150,575 in the same period of 1946. Great Britain has contracted for about 24,000 tons of copper from Canada, to be delivered in the first half of 1948.

★Shipments of nickel in the United States and Canada in 1947 will show an increase of about 50% over 1937, it was reported by Robert C. Stanley, chairman and president of the International Nickel Company of Canada. The continuing labor shortage at the mining and smelting center of Copper Cliff was a factor in holding operations considerably under the wartime production record attained in 1943. The steel industry was the largest consumer, chiefly for nickel-chromium stainless steels. Nickel alloys found broader applications, including jet engines, gas turbines, rolling mills, as well as grinding, milling, and other mining applications. Production of nickel in the first ten months of 1947 was 96,822 tons compared with 78,612 tons in the same period of 1946, as reported by the Dominion Bureau of Statistics. October output was 11,487 compared with 8,721 tons for the same month in 1946.

★Mineral production in 1947 was estimated by the Dominion Bureau of Statistics at $619,100,000 compared with the previous record value of $566,700,000 in 1942 and $502,800,000 in 1946. While metals failed to measure up to the record of other years on a tonnage basis, higher prices for both metallics and nonmetallics accounted for the notable advance. The removal of price controls on metals in June resulted in an increase in value of more than $100,000,000 to $389,500,000. Copper output was up 23% and the value jumped 96% to $91,300,000. The tonnage of zinc was down but the value improved 27% to $46,500,000. Lead tonnage also dropped while the value was almost doubled to $44,300,000. In spite of the reduced gold price, production improved 7.2% to 3,035,161 fine oz. valued at $106,200,000. Record production and value of gypsum was 2,390,157 tons valued at $4,388,745; salt increased from 537,985 to 731,515 tons. Asbestos was up from 558,181 to 662,533 tons valued at $31,800,000. Structural materials increased in

value from $66,100,000 to $72,700,000. The 1947 silver production (first ten months) was 9,688,317 fine oz. compared with 10,728,608 in the same period of 1946.

QUEBEC

★The monthly mineral report of the Quebec Department of Mines showed a major advance for clay products in the first ten months of 1947, the value at $3,496,306 being 22% higher than for the same period a year ago. Asbestos was up 18% at 538,061 tons, while lime moved ahead 16% at 284,169 tons, and cement improved 5% to 4,619,632 barrels. Gold recovery showed a decline of 5% for the first ten months at 508,274 fine oz., and silver dropped 13% to 1,519,581 oz. from 1,749,738 oz. produced in the first ten months of 1946.

★Dave H. Angus, president of Consolidated Beattie Mines, reported November production of $128,523, against operating costs of $131,999. Ore treated was 29,800 tons, with average recovery of $4.31 per ton. About half the tonnage milled was drawn from the Donchester orebody and the balance was from the Beattie "A" zone. Overloading a single unit of the roaster plant resulted in recovering only 75.5% of the gold, which has led to making use of the complete roaster in an effort to secure normal recovery up to 89%. High costs have been caused by replacements of deteriorated equipment, the result of the long shutdown, and heavy costs for removing silt from stopes in the north zone orebody, where a long period of reclamation has been in progress. Efforts are being made to remove the clay from the north zone above the fifth level, for the time being making no attempt to gain access to the 1,270,000 tons of ore blocked out on the sixth and the three winze levels.

The new management has made steady progress in rehabilitating the mine to the point where normal operations can begin to show a profit. The third level connects with the Donchester mine and was equipped with an electric trolley for moving ore, replacing the surface railway formerly used. This new equipment began to function in January and employs 4-ton Granby type cars that are operated by only two men. George W. Robinson is mine manager.

★The mill of Louvicourt Goldfield Corporation in the first six months of operation had advanced to 400 tons a day and to 500 tons in November, as reported by the president, Pierre Beauchemin. In this period 70% of the ore was drawn from stope preparation and the balance from regular stoping. Development is now in progress on the 675-ft. level. Operating costs of $4.19 a ton in November and December were expected to be met by gold recovery from better grade ore, and an attempt was being made to lower costs under $4. The grade

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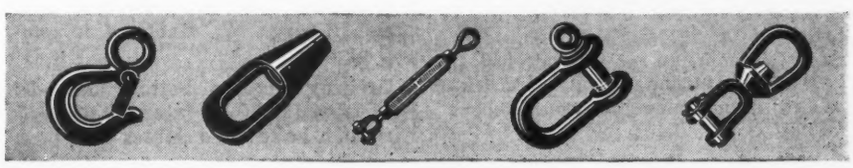
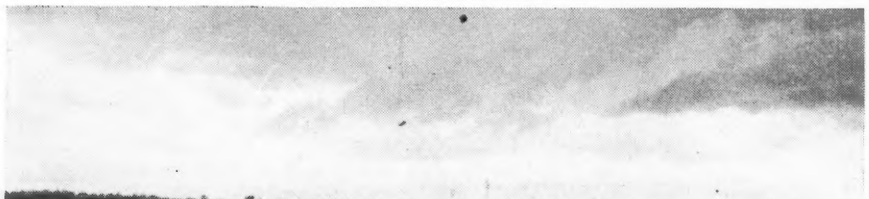


A FINISHED STRETCH of the recently completed $3,000,000 highway which connects Red Lake, northwestern Ontario, with Vermillion Bay. James Montagnes photo.



THE TOWN OF RED LAKE, in the Red Lake gold mining district, Ontario. Formerly dependent on water and tractor-sled transportation, this area is now served by a 102-mile highway. James Montagnes photo.

Canada *(Continued)*

averages about $5 a ton. Gustave Maher is mine manager and A. Heather is mine superintendent.

★A. C. Lee, consulting engineer and vice president of Thurbois Mines, Destor township, reports that a combined length of 551 ft. of ore on the 250-ft. level has been opened and the extension of ore sections has been indicated by test holes. Rhyolite is the main ore-making rock. The widths range from 6 to 14.5 feet. Underground work has advanced for only 650 ft. of the total length of 1,700 ft. indicated by diamond drilling, and in the north area development is in progress, indicating an increase of one-third in the previous tonnage estimates. The new information is expected to advance the ore estimate to 700 tons per vertical foot. If ore continuity proves to be satisfactory it is proposed to install a 500-ton mill. Underground work has shown the ore to occur in an echelon arrangement branching off the main shear zone, with subsidiary fractures largely responsible for the increase in the suggested tonnage. A. D. Dickson is mine manager and Robert Slutsky is president.

★John W. MacKenzie, mine manager of Lake Wasa Mining Corp., Beauchastel township, announces an increase in both value and tonnage of reserves as a result of development on the 600 level. As reported a year ago, the ore graded $5.74 for a continuous length of 1,250 ft. The width indicated by east-west scram drifts is 21.4 ft. Work started in January to deepen the shaft to allow opening a third production level at 800 ft. Plans have been discussed for mill construction to handle 1,000 tons a day. Edward Futterer is consulting engineer.

ONTARIO

★The sintering plant of Algoma Ore Properties shipped 501,821 tons of sinter in 1947 compared with the 1946 peak of 551,986 tons. All ore came from the Victoria mine, where rock stripping is continuing through the winter. Underground development is in progress at the Helen mine, also located on the Michipicoten iron range. George W. MacLeod is general manager.

★Drifting on the bottom 5,850-ft. level from the No. 2 internal shaft at Kirkland Lake Gold Mines has been reported to be the object of new exploratory work tracing the downward extension of the west zone. This structure is at some distance from the main break, where production has been secured on the old shallow levels. Ore lengths in the west zone at the 4,900 horizon totaled about 1,000 ft. Production has been averaging better than 240 tons a day and a substantial increase in gold content has been found in new sections on the west zone. Ore lengths on the 5,450 level exceed 2,500 ft. in the four veins developed. Stope development has been started on the 5,340-ft. level. G. C. Dunn is general superintendent.

★Completion of the 102-mile gravel highway between Vermillion Bay and Red Lake mining district, Ontario, now allows all-year traffic to this district which was formerly dependent on water transport and tractor-sled transport for the shipment of food, supplies, and heavy machinery.

The highway cost 3 million dollars and was completed in the record time of six months. Construction of the road required the clearing of 1,325 acres of forest, close cutting an additional 900 acres, moving 14 million cu. yd. of earth and 250,000 cu. yd. of rock, and spreading 250,000 cu. yd. of top dressing and gravel. Nearly one-half mile of trestle and bridge structure had to be thrown across rivers and lakes. The longest span was 580 ft., across Trout Lake River.

The new highway saves time and money for the mining companies. Previously it took two days and nights to make the trip by tractor-sled in winter or by water in summer. Now the trip can be made in four hours by heavy truck. Freight shipments cost $100 per ton by air, $40 by winter tractor-sled, and $20 by water. The new road will bring the cost down to $5 per ton and save about $300,000 a year for the Red Lake gold camps.

SASKATCHEWAN

★J. L. Phelps, minister of natural resources for Saskatchewan, announced on December 24 that the provincial government would soon launch a vigorous program to assess Saskatchewan's mineral resources, and to encourage their development. A technical staff is being built up under W. J. Bichan, newly-appointed director of mineral resources, preparatory to a campaign to find new mineral deposits in the northern part of the province. Several geological parties will take the field this summer. Special assistance will be given prospectors and mining companies in the form of free transportation to likely areas and reductions in existing royalty rates for mines in development. Mineral production in Saskatchewan for 1947 had a value of about $32,000,000.

★During 1947, a second metal-producing company joined Hudson Bay

Mining in the province. The company is Newcor Mining & Refining, Ltd., at Douglas Lake, near Flin Flon. A 200-ton mill has been built and a small smelting plant has been set up. Reserves in sight were estimated at 40,000 tons of arsenical gold ore, said to carry about 0.45 oz. gold per ton and 300 lb. per ton recoverable arsenic.

MANITOBA

★Nickel Lake Mines, Ltd., in which God's Lake Gold Mines and Bobjo Mines have substantial interests, is reported to be drilling an anomaly some 20 miles east of Lynn Lake. Float carrying more than 3% copper was found nearby.

★Employees of Sherritt Gordon Mines at Sherridon, in a referendum conducted by the Manitoba Department of Labour, voted to retain the International Mine, Mill and Smelter Workers' Union (C.I.O.) as their bargaining agency. The MMSW obtained a majority of 40 votes over the A.F.L. affiliate seeking certification. At Lynn Lake the company has resumed drilling on the "B" orebody suspended last winter when work was concentrated on the "EL" body. Initial results appear to be better than the average of 0.84% nickel and 0.55% copper obtained in the 1,486,000 tons previously indicated.

★The Department of Mines and Natural Resources has released the details of an agreement with Howe Sound Exploration Co. outlining the responsibilities of the company to the new mine town of Snow Lake. The company undertakes to spend $325,000 in the development of the townsite. Townsite improvements totalling $175,000 include surveys, improving streets, lanes and sidewalks, installing water mains and a sewage system, and constructing electric power lines. Buildings constructed, or to be constructed, by the company have an aggregate value of $150,000 and include a school, hospital and community center.

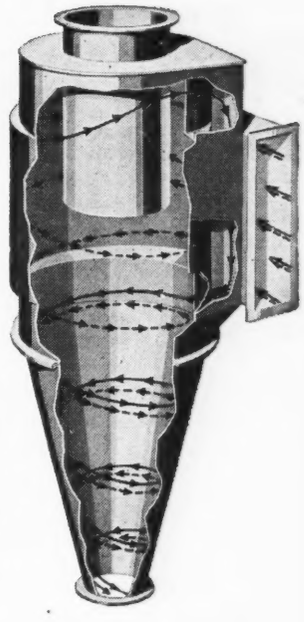
The company further agrees to maintain streets, lanes, drains, sidewalks and the sewage and water systems. It will also supply electric power for street lighting and provide fire fighting equipment. In addition an annual sum of $6,000 per year will be contributed to the local government district of Snow Lake. In return the company will receive a certain number of lots at a nominal price and local tax concessions for a number of years. The present agreement terminates December 31, 1951, but is subject to renewal.

BRITISH COLUMBIA

★After several years in the office of vice-chairman, H. R. Banks, superintendent of the Sullivan concentrator of Consolidated Mining and Smelting Company of Canada, has been elected

in planning

Dust Recovery



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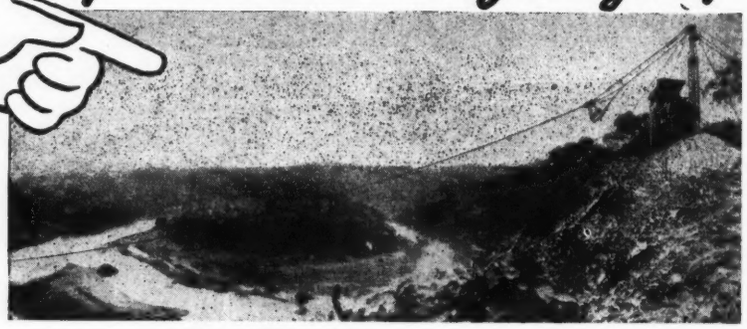

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Canada (*Continued*)

chairman of the B. C. Section, Canadian Institute of Mining and Metallurgy for 1948. The first and second vice-chairmen-elect are respectively H. S. Fowler, manager of Pacific Lime Co., Ltd., Blubber Bay, B. C., and Dr. D. F. Kidd, in charge of exploration for Leitch Gold Mines, Ltd., and associated companies.

The following will compose the executive committee: Dr. C. E. Cleveland, L. G. R. Crouch, J. M. Cummings, W. B. Paton, Dr. Chris Riley, Harold M. Wright, R. S. Douglas, T. G. Ewart, A. C. Freeze, Dr. M. S. Hedley, J. G. Pearcey, C. M. Manning, C. D. Stevenson, and T. M. Waterland. The first six of the above-named members, all of whom are resident in the city of Vancouver, will comprise the administrative section of the committee.

The chairman-elect has also been elected vice-president of the Institute representing District No. 6, which includes British Columbia and Yukon. R. E. Legg, F. A. McGonigle, and E. C. Roper have been elected for two-year terms as councillors representing District No. 6.

★Frank E. Woodside, veteran manager of the B. C. and Yukon Chamber of Mines, reports 1947 as the busiest year within his recollection as regards prospecting for base metals. No less than 19 large eastern Canadian or United States exploration companies, he states, during the year have considered, with varying degrees of interest, the possibilities of locating commercial ore deposits in British Columbia and Yukon. These included: Conwest Exploration Co.; Hudson Bay Exploration and Development Co.; Hollinger Consolidated Mines; American Metal Company of Canada; Mining Corporation of Canada; Leitch Gold Mines; Butler Bros.; Ventures; International Mining Corporation (Canada); Kennco Exploration Co.; International Nickel Co. of Canada; Quebec Gold Mining Corporation; Noranda Mines; Transcontinental Resources; American Smelting and Refining Co.; Anaconda Copper Co.; Alaska Juneau Gold Mining Co.; New Jersey Zinc Co.; and Trans-American Mining Corporation. With the continuing high prices for nearly all base metals, and the renewed demand for tungsten, Mr. Woodside anticipates another busy year in 1948.

★Morris Summit Gold Mines, Ltd., Portland Canal district, has temporarily suspended advance of its low-level drift on the "A" vein on account of faulted ground requiring timbering. In the meantime a crosscut will be driven to the "C" vein, in which diamond drilling has indicated commercial deposits. Approximately one-half of the 600 ft. of drifting on the "A" vein was advanced in ore. Two good sections included a length of 38 ft. assaying 1.04 oz. gold across an average width of 18 in. and another

of 147 ft. averaging 0.975 oz. over 29 in. Last face assays showed 0.44 oz. across 46 in.; 0.60 oz. across 56 in., and 1.42 oz. across 60 in.

★Nitinat Mines, Ltd., has shipped its first carload lot of concentrate from the Black Panther mine, Alberni district, Vancouver Island. The shipment weighs 26 tons and mill assays indicate a grade of 8.0 oz. Au., 12.0 oz. Ag., 5.0% Zn., and 8.7% Pb. All work was suspended at the camp during the Christmas holidays and will be resumed January 5 with a 17-man crew under the direction of Eric Hanson, mine manager. Finance supplied during the past year by Cunningham Development Co., Ltd., was responsible for placing the property in production on a 25-ton-per-day basis. Marcus H. Cunningham, president and managing director of the financing company, is in general charge. He was formerly managing director and underwriter of Macdonald Mines, Ltd., in the Rouyn district of Quebec. A considerable amount of work was done on the property during the early part of the war by Pioneer Gold Mines of B. C., Ltd.

★Bralorne Mines, Ltd., is making satisfactory progress in its long low-level drive to intersect a series of veins indicated by outcrops and diamond drilling on its large group of claims on Shulaps Mountain, Yalakom River area, about 25 miles west of the Bralorne mine. The tunnel has been advanced 1,200 ft. and work is continuing on a three-shift basis with 22 men employed on the project. The Yalakom discoveries in 1941 created a stampede to stake claims in the area.

★November production of Island Mountain Mines Co., Ltd., Cariboo district, was 1,193 oz. gold, valued at $41,755, from 2,970 tons, averaging 0.40 oz. gold per ton.

★Williams Creek Gold Quartz Mining Co., Ltd., is preparing plans for an extensive development program to be initiated early in 1948 on its 28-claim property adjoining that of The Cariboo Gold Quartz Mining Co., Ltd. The initial phase will include the sinking of a centrally-located shaft to a depth of 350 ft. and lateral development on the 4,000-ft. horizon of the Black Jack, Wintrip, and Westport areas. The sum of $270,000 has been allotted to cover the estimated cost of this work and a figure of $800,000 is contemplated for ultimate expenditure. The company is financed jointly by Noranda Mines, Ltd., and Quebec Gold Mining Corporation, and 800,000 of the 3 million authorized shares of capital stock were paid to the Cariboo Gold Quartz company for properties.

★North American Goldfields, Ltd., is erecting a dragline dredge and complete washing plant on Peters Creek in the Cariboo district. Glenville A. Collins, managing director, states it is expected to have the new operation

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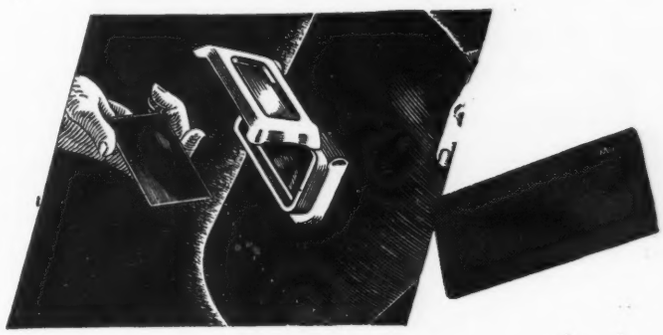

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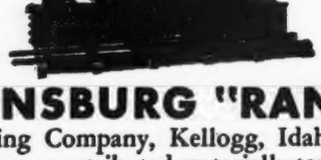

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Canada (*Continued*)

functioning early in 1948. He has just returned from Colombia, S. A., where he has supervised installations for an hydraulic mining operation for the same company on the Amaceri River. At the latter property, he left George A. Ball, formerly of Vancouver, in charge.

★Highland Silver Mines, Ltd., has completed more than half of its projected drive of 1,200 ft. to the favorable zone near the contact of the Wallace formation and the diorites at its Beaverdell district property. At the ultimate point of intersection, "backs" of 400 ft. have been estimated.

★Brooklyn-Stemwinder Gold Mines, Ltd., is driving a main haulage tunnel at its property at Phoenix, B. C. The work was delayed because of the necessity of timbering and cementing the unusually heavy overburden at the portal. It is expected to cut both the "80" and "150" veins with a drive of 250 ft. A second portable compressor has been added to the power supply.

★Pouring of the first gold brick is anticipated almost any day by Kenville Gold Mines, Ltd., Nelson district. The new 125-ton mill is now in full operation. Reserves have been estimated at 130,000 tons grading 0.6 oz. gold per ton by W. B. Montgomery, mine manager.

★The annual meeting of shareholders of Reeves, MacDonald Mines, Ltd. Nelson district, was advised by Lewis P. Larsen, president, that every effort would be made to place the company's property in production on a 1,000-ton daily basis during 1948. He said the company had to date been unsuccessful in its attempts to obtain a 2,000-ton mill in the state of Nevada. However, he explained that restrictions on the sale had recently been removed by War Assets Administration and the company was now hopeful of obtaining delivery. He expected the Reeves MacDonald operation to be one of the lowest in cost in North America and anticipated a handsome profit on the mining of ore already developed, which was estimated between 2½ and 3 million tons grading better than 1% lead and 6% zinc.

During the past year 4½ miles of new road, capable of supporting very heavy trucks, was built to connect the property with Nelway, on the main highway. This will furnish an outlet for concentrates to the Trail smelter or the railway lines. The mine camp has been rehabilitated, new buildings erected, the main adit re-timbered, and the portal cemented. The president said it was intended to employ open-stoping methods with all ore falling to the main-haulage tunnel, where it would be loaded on trains (or conveyor belts) by Joy loaders, a method which, he said, had been successfully applied in large operations in the United States. To

facilitate mining, the management is now driving a long raise to connect the two levels, more than 800 ft. vertically apart.

Stanley J. Crocker, president and managing director of B. C. Equipment Co., Ltd., was added to the board of directors to fill the vacancy caused through the death last year of James Anderson. Other directors elected were Mr. Larsen and Jens Jensen, Spokane, Wash.; C. A. R. Lambly, Metaline Falls, Wash.; and Miss J. Whitehouse, Vancouver, B. C. The balance sheet showing a capital surplus of $221,237 as of August 31, 1947, was approved. Expenditures last year aggregated $48,945.

YUKON

★Alex Steffansson, of Aklavik, son of the Arctic explorer, went into the Firth district with the two prospectors, H. Blair and R. Sandy, who have confirmed the discovery of an important gold area 400 miles north of the Klondike on the Firth River. They reported $35 to the cu. yd., of some gravel sampled. Two American miners were taking out 2 oz. of gold per hour when visited by Sandy and Blair, but Mr. Sandy said large scale development will be necessary to determine the gold contained in the wide benches of gravel.

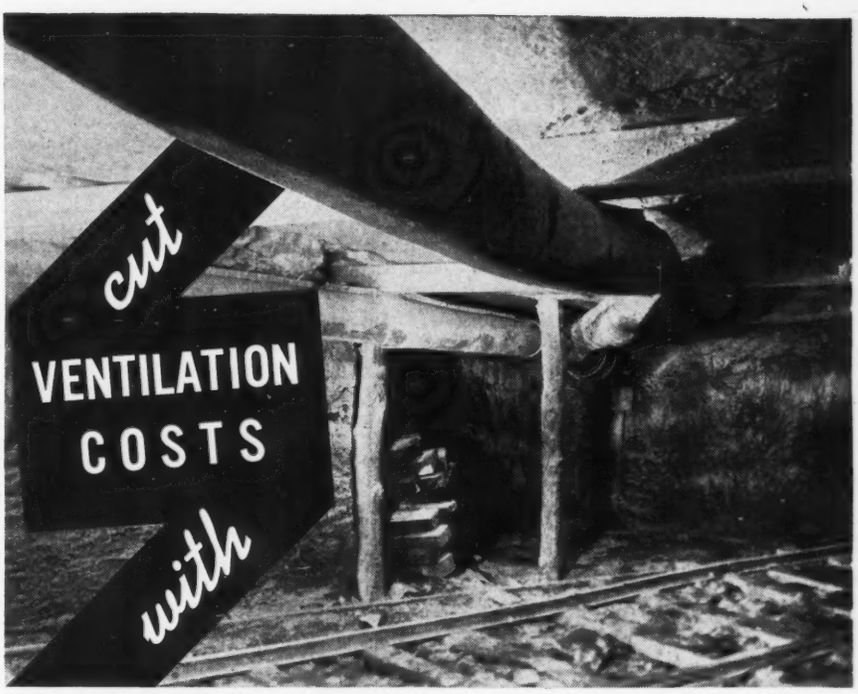
★Company officials are pleased with the tonnage of ore being mined at the Mayo silver camps. The new overland route is an important factor to the camp. The road between Mayo and Minto on the Yukon was expected to be used for winter hauling. About 500 tons of freight was to be trucked from Minto to the silver camp while ore will go out on the return trips.

ALASKA

Dredge operator cites higher costs as reason for curtailed mining

★Graham D. Lammers, who operates a gold dredge in the Kotzebue district, 100 miles north of the Arctic Circle, on Klery Creek, told the Northwest Mining Association, in Spokane, Wash., that "the gold miner of Alaska could be saved by a free market for gold which would double the gold development of the Territory." He pictured the future of gold as dismal, and said because of high prices not much capital would be ventured. An increase in the price of gold would save the placer miner, he said, but he was not optimistic about that. Four dredges were now being used, in comparison with 40 in 1941. His costs had risen from 20c. a cu. yd. for dredging gravel in 1940, to 33c. in 1947.

★Mr. and Mrs. R. A. Brown have acquired 34 claims on Uhler Creek, in the Fortymile area from C. Murray,



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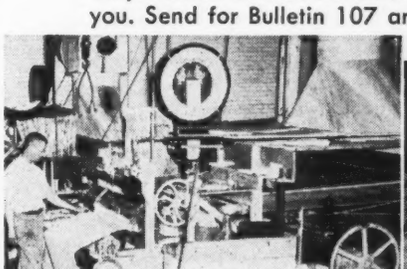

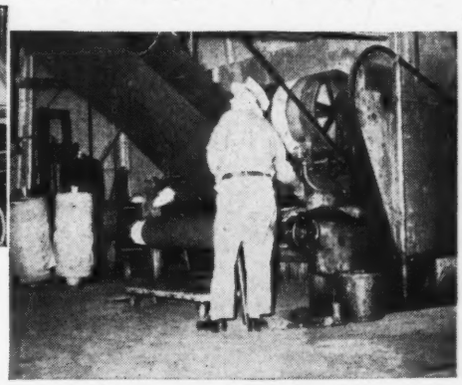

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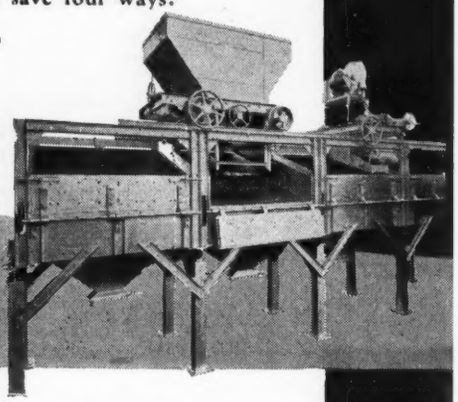

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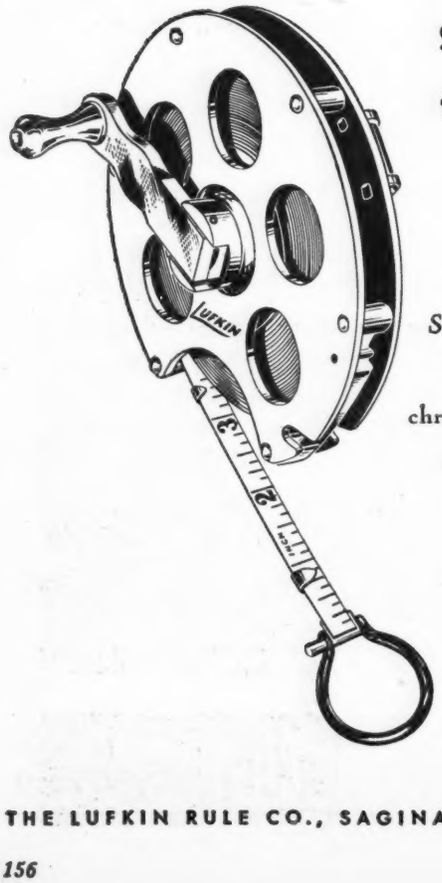

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Alaska (*Continued*)

who has been preparing the ground since 1936.

★Bert Libe, of Ketchikan, and others are willing to relinquish claims staked near Point Higgins, because of an error in a tin assay. Mr. Libe said the deposits do not contain tin in commercial quantities, as was believed earlier.

★Alaska's mineral production, in 1946, was $12,430,000 compared to $10,174,000 in 1945. The increase was due to partial restoration of gold mining. A new high in coal output was reached and a fairly steady yield of crude platinum. The Bureau of Mines listed Alaska's production for 1946 as follows: coal, $2,359,000; copper, $648; gold, $7,937,335; lead, $25,070; mercury, $68,670; silver, $33,769; platinum, 22,882 troy oz.; and miscellaneous, $2,005,241.

MEXICO

Aleman gets new powers to help local mining industry—Aforo tax dropped —Minimum daily wage increased

★Better times for mining in Mexico are indicated by several recent Government actions. Prominent among them was the action of the Congress in voting a constitutional amendment giving the President new powers to help the mining industry. What form this help will take is a matter of much speculation, in view of Mexico's 1948 budget, which is at a record high level of 2,300,000,000 pesos. Taxes will probably continue high, yet relief from burdensome taxation is one of the things Mexican mining needs most. The meeting in Mexico City next March of representatives of government, management, and labor from the mining industry is expected to help President Aleman shape his course.

★Workers of the San Carlos unit, Chihuahua, of Cia. Minera Nacional, S. A., are demanding a 50% wage increase plus a 12% annual bonus from the company's profits distributed pro rata according to wages.

★Unionized employees of Asarco's Santa Eulalia unit in Chihuahua were talked out of a strike for higher wages recently by the Labor Ministry. The union agreed to send representatives to a meeting with company officials in Chihuahua City arranged by the Ministry.

★A. S. & R., the Fresnillo Co., and some smaller companies affected by the action, have asked the Labor Ministry to modify its order that they send representatives to Mexico City to discuss revisions of work contracts soon to expire. To avoid extra expense in time and money, the com-

panies would prefer to hold the meetings in the centers affected by the pacts.

★The official minimum daily wage has been raised in many parts of Mexico, giving some mining companies a new problem. This minimum wage is fixed every two years by committees of government, labor, and management in the various zones in the country affected by one pay scale. The committee's findings are reviewed by the Board of Conciliation and Arbitration and can be raised or lowered at the Board's discretion. For the period 1948-1949, a new high was set for several mining communities in Sonora with a daily wage of 8.17 pesos. The new urban rate for the Federal District was reduced 30 centavos from the 1947 rate of 4.50 pesos.

★The new export tax system that went into effect on January 1 increases the levies on mining products. Many items are exempt under the new regulations, and the old *aforo* tax of 12% additional has been abolished, but rates still are high. In several instances, export taxes amount to as much as 20% ad valorem.

PHILIPPINES

Gold yield for 1947 will reach about $2,400,000—Benguet Con. again in operation—Surigao still unwatering

★Total gold production in the Philippines for 1947 will approximate $2,400,000 in value. Most of this came from operation of the Big Wedge mine in Baguio, which resumed production in March and steadily increased output until pre-war capacity was attained in October, when 12,575 tons were mined and milled. Production of the Big Wedge mine for the 9½ months of operation totalled approximately $1,675,000. Surigao Con. followed with about $600,000 for the year. The balance came principally from a dredging operation in Surigao, and some hand placer work. No account is taken of the by-product gold contained in large shipments of copper concentrates from the Lepanto mine sent to the United States for smelting. These concentrates did not represent new production, but had been left behind by the Japanese when they were driven out after the conclusion of hostilities.

★Benguet Con. resumed mining and milling operations at Benguet and Balatoc on December 24 after a five-year shutdown during the war and the rehabilitation period. The initial crushing plant operation of 400 tons a day started as scheduled, with an increase to 1,200 tons expected within 30 days. Ultimately the mill is planned to operate at 4,000 tons a day. About 2,000 native miners are employed.

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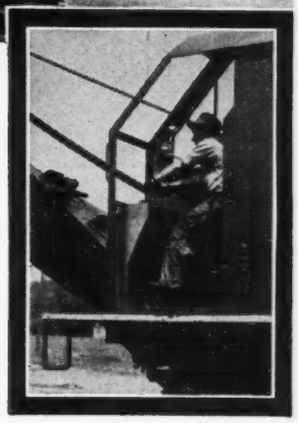

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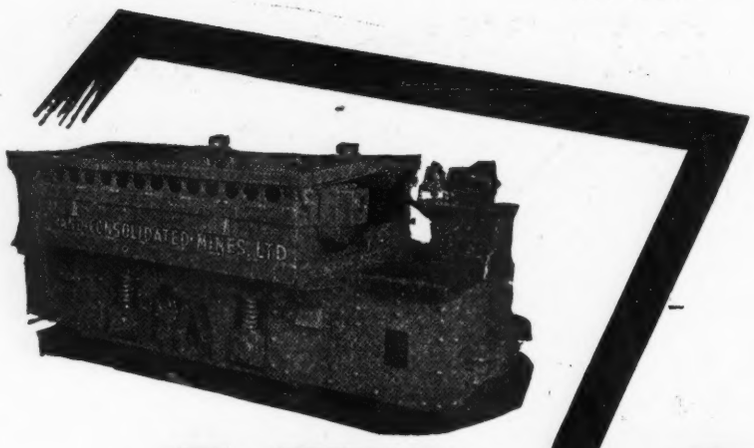

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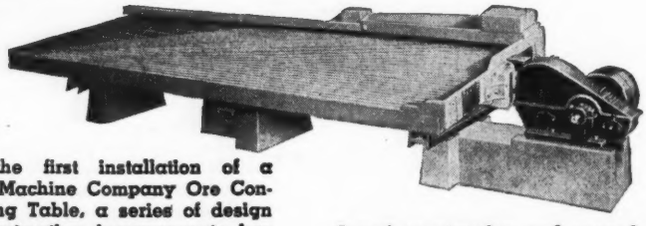

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Philippines *(Continued)*

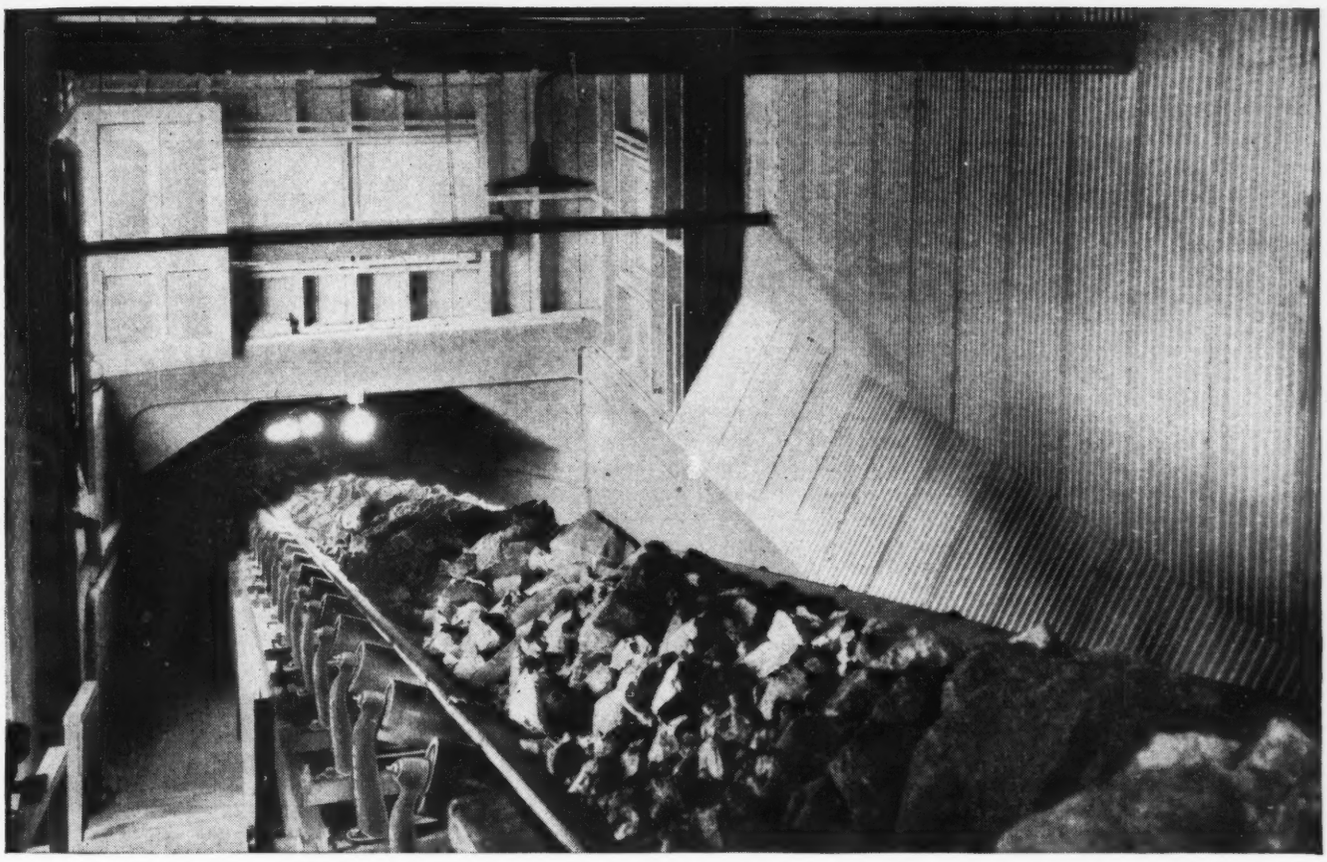
★Mindanao Mother Lode reported that its first postwar production for October amounted to $35,500 from 1,900 tons of ore milled, representing a recovery of about $18.50 per ton. Pumping out the lower levels of the mine has been in progress for several months, and by the middle of November the lowest, or 700-ft., level had been drained. The pumps handled about 2,000 g.p.m. Both the 400 and 540 levels were found to be in good condition when unwatered. The new flotation mill has been operating only intermittently on ore from a small low grade ore shoot on the 50 vein above the water level. Until permanent station pumps are installed on the 700 level, stope production from the Tabon Tabon vein will be very limited. The mill has a proven capacity in excess of 10 tons per hour with excellent metallurgical results. The new diesel power plant, consisting of two 850 hp. engines, has been in operation since August. Resumption of sinking operations in the No. 2 shaft is planned for early in 1948. Douglas McKay is general manager of the company.

★Surigao Con. has been milling 4,000 to 6,000 tons per month during the year, practically all of which came from surface mining. About $50,000 a month was realized from this production. Unwatering the old mine has proved to be a long, difficult job. The main hoisting shaft has been completely repaired, and some ore from underground is now going to the mill, with the amount due to increase rapidly as more area is opened up. The main orebody has been unwatered below 200 ft. and timbering generally is in excellent shape. As soon as possible the 400 level will be cleaned out, and the shaft will be continued to 600. About half of the production of the mill is being sent to the United States in the form of concentrates, and the other half is obtained as bullion which is sold on the local Manila market.

ITALY

Uranium and thorium to be mined in Cuneo Province — Zinc found in Sardinia

★A reservoir of methane gas, reported to be about 10 billion cubic meters in extent, has been discovered by the Societe Metalifera Ravennate between Ravenna and Ferrara. At a depth of about 600 meters, the reservoir is now being tapped at the rate of about 3,000 cubic meters daily. The gas will be piped to Bologna. The Italian Government has removed restrictions on import of machinery for extraction of methane gas, as well as those on sale of the product.



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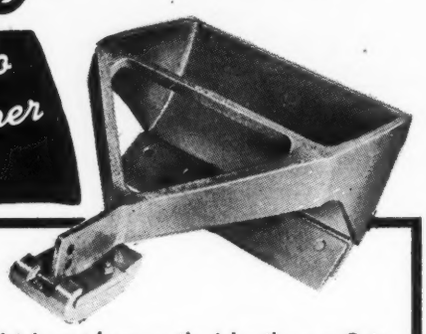

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Italy *(Continued)*

★In a recent report to the Supreme Mining Committee, Premier de Gasperi stated that a new source of bauxite had been discovered in the Gargano Peninsula of Southern Italy. Reserves are estimated at 30 million tons. The report also said that an important zinc formation had been discovered on Sardinia near Monteponi.

★The Italian Government Mining Organization has discovered new coal mines at Porto Veme near Cagliari. Preliminary estimates indicate that the new mines should double Italian coal output, which now runs about 3 million tons yearly.

★Important deposits of uranium and thorium have been located in the Lurisia zone in the province of Cuneo. Initial exploration was made with French capital. To exploit this discovery, a stock company is being formed in Milan. The Italian Council of Research in Rome, a Government agency, has been officially appraised of the discovery.

AFRICA

Welgedacht gets started after 50 years—Oil-from-coal industry to be established—Gold in Mozambique

★Established over 50 years ago, Welgedacht Exploration Co. treated its first gold ore on Dec. 9, when G. V. R. Richdale, chairman of the company, started the first conveyor belt in the mill. The company has a history that is probably unique in mining annals. Shaft sinking on the company's property started in 1899, but the Boer War brought it to a halt. Then when sinking was resumed in 1905, a coal seam was cut, and the company operated as a coal mine until 1919, when it was closed down. When the Union went off the gold standard in 1933, the company again began to look for gold, but development was stopped once more by the war in 1939. After the war, the ending of the special gold mining levy in 1946 made work possible, and sufficient ore has now been developed to justify a production rate of about 25,000 tons monthly. The mine should produce about 60,000 oz. of gold yearly. Manager of the mine is J. D. Smuts, a son of General Smuts.

★The recent report of Anglo-Transvaal Consolidated Investment Co. states that the company's ten years of work to develop a feasible process for making oil from coal is in its final stages. It has been determined that it will be economical to establish such an industry based on comparatively low grade coal deposits, and application has been made for a license to set up large scale plants in the Transvaal.

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Africa *(Continued)*

★A policy of vigorous exploration is being followed at Witwatersrand Nigel's large property with a view to justifying a new shaft and a larger reduction plant. Development footage for the first five months of the current financial year amounted to 6,701 ft., and of the 3,920 ft. sampled, 1,425 ft., or 36.35% was payable, the average value being 12.02 dwt. over 19.57 in., equal to 235.3 in dwt.

★Gold yield on the Rand for November was 945,125 oz., a drop of 41,948 oz. from the October figure of 987,073 oz.

★Tanganyika's mineral exports for the first nine months of the current year show a big drop from last year's figures, falling to £841,000, against £1,134,000 last year. The drop is largely accounted for by decline in market value of diamonds produced in Tanganyika. The quantity of diamonds exported fell from 88,000 carats to 62,000 carats, but the value went from £715,000 to £443,000.

★Recent surveys in the mining district of Tete in Mozambique have found rich coal deposits in one area. Rich copper and gold deposits have also been reported.

INDIA

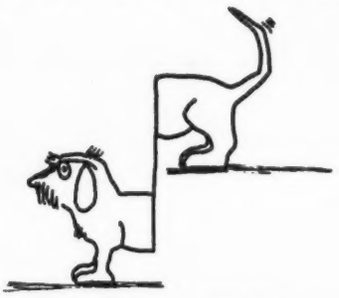
Rock burst kills ten in Champion Reef mine—India expands aluminum plants

★The worst rock burst in several years occured late in November in the Kolar gold fields, taking the lives of 10 men, one of them a British engineer who was leading a rescue party. The burst affected the 82nd to 85th levels of the Heathcote shaft of the Champion Reef mine. Ten other men were rescued, four of them members of the first rescue party, which had been trapped by subsequent bursts. Fire hampered rescue work, and finally several sections of the mine had to be sealed off.

★Production figures for the Kolar gold field for October were as follows: Champion Reef, 3,688 oz.; Mysore, 1,498 oz.; Ooregum, 2,282 oz.; Nundydroog, 4,329 oz. The total of 11,797 oz. was a sharp drop from September's total of 14,179 oz.

★The Indian Government has begun conversations with various oil companies with a view to establishing more oil refineries in the dominion. As a result of partition, both India and Pakistan have one refinery each. India's is at Digboi in the Assam oil fields, and Pakistan's is near Rawalpindi in the Attock fields. The Digboi refinery handled 183,998 tons of oil in 1946. Imports of refined oil into Pakistan and India together totaled 2,549,856 tons during 1946. The cur-

GOOD ENGINEERING



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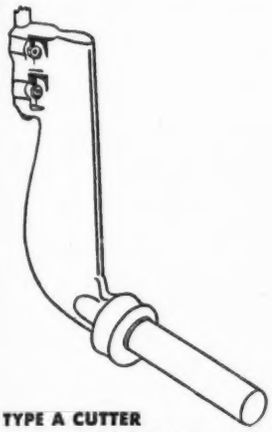
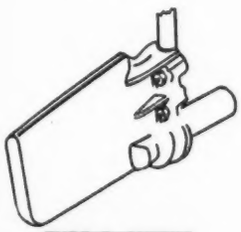
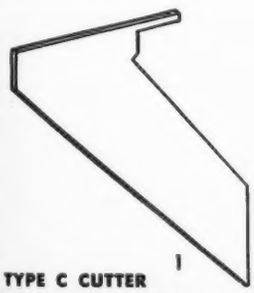


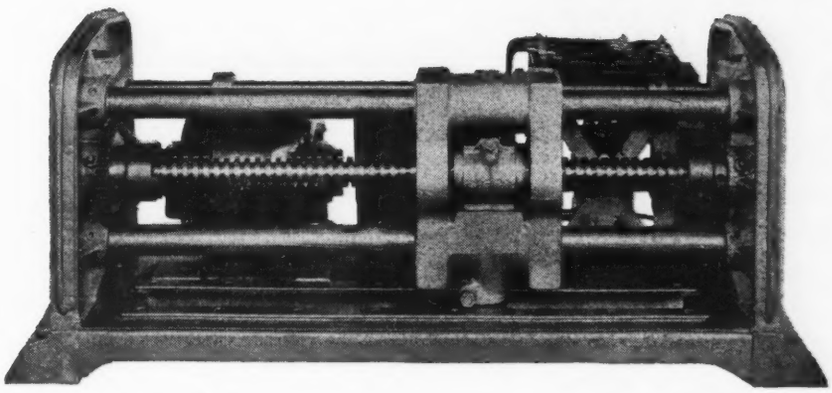
TYPE A CUTTER
For wet material flowing in a sloping launder, flume or pipe.



TYPE B CUTTER
For wet material flowing from a vertical pipe or spout.



TYPE C CUTTER
For dry material flowing from chute or over conveyor pulley.



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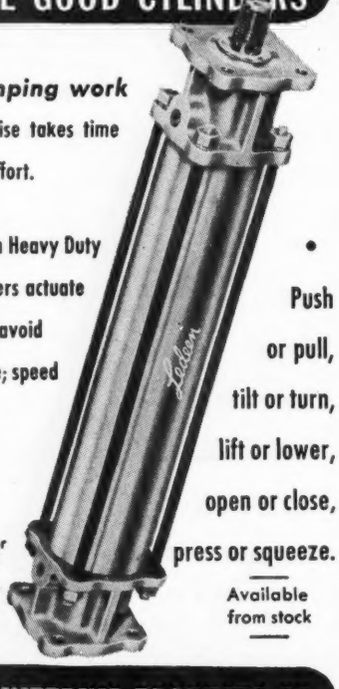

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India (*Continued*)

rent plan is to set up refineries at ports to handle imported crude oil.

★Pakistan is pressing mineralogical surveys of East Bengal Province in an effort to locate a basis for industries in the predominantly agricultural section. Finds to date include a high-grade pyrite deposit, several hematite deposits, and a coal deposit. Drilling concessions are expected to be granted soon for work in Chittagong and Slhet districts, where oil is indicated.

★Indiana Aluminum Co., whose reduction plant in Travancore State produces roughly 2,000 tons of aluminum annually, is developing two bauxite deposits in Bihar Province, north India. A plant in Bihar is being built to produce alumina for shipment to Travancore for reduction. Most of the Travancore output of metal will go to a factory now being built at Kundara in the same State, where aluminum cable will be made. Another aluminum company, Hindaloo, Ltd., is setting up a reduction plant in the extensive bauxite field in the Central Provinces. It is not expected to be operating until about 1950, however.

AUSTRALIA

New gold orebodies a possibility for Western Australia—Bendigo field on wane—Big backlog at Port Pirie

WESTERN AUSTRALIA

★Is the State in for another Golden Age? Has half a century of prospecting brought to light only the first harvest of orebodies and left untouched substantial lodes concealed underneath a false bottom of sandstones, conglomerates, lavas, and other intrusives? These questions arise from claims made for diamond drilling by Mr. H. J. Connolly, a consulting mining geologist. The development of the Phoenix leases in the Central Norseman group is due to Mr. Connolly's diamond exploration, and he is now discussing with the State Mines Department and Big Bell, Ltd., a plan to drill the Great Fingall mine at Day Dawn to a depth of 5,000 ft. The assistance of a Canadian expert team of drillers will be sought.

★Although costs are steadily rising against a rigidly pegged price, recovery on all major gold fields is steadily continuing and, on present indications, the Australian gold yield for 1947 may well exceed 900,000 oz., including the relatively small production in other states. On this basis, the improvement over 1946 is about 10%.

★New Coolgardie Gold Mines, N. L., has been registered in Melbourne with a capital of £600,000 to operate a mine in the Coolgardie field. Most of the shares have been taken up by Western Mining Corporation.

★North Kalgurlie (1912), Ltd., is developing rich ore lodes, about 500 ft. northeast of the North Kalgurlie shaft, down to the No. 8 (962-ft.) level, which is the lowest level in the mine from the North Kalgurlie shaft. Values will also be investigated from the 1,150 ft. level, Kalgurlie shaft, and for this purpose No. 16 level is being driven and will be equipped with mechanized transport to handle all the ore mined below No. 8 level, North Kalgurlie, as soon as that shaft has been sunk to connect with No. 16 Kalgurlie level. The Kalgurlie shaft has been retimbered and is now capable of dealing with all the ore that the mine can produce.

★As part of the long-range government plan to diversify the state's economy, the new conservative state administration has decided to continue the labor government's policy of sponsoring public-private partnerships to develop the state's iron resources. A fully government-owned charcoal iron-blast furnace with a yearly capacity of 10,000 tons is ready to be blown in at Wundowie, 41 miles east of Perth.

A bill will be introduced to authorize the state government to share investments with private concerns for the purpose of mining of iron ore and a processing ore, iron, and steel. The act will first be applied to an arrangement with the English mining engineering firm of H. A. Brassert & Co., Ltd., to exploit its iron ore leases on Kooland Island.

NORTHERN TERRITORY

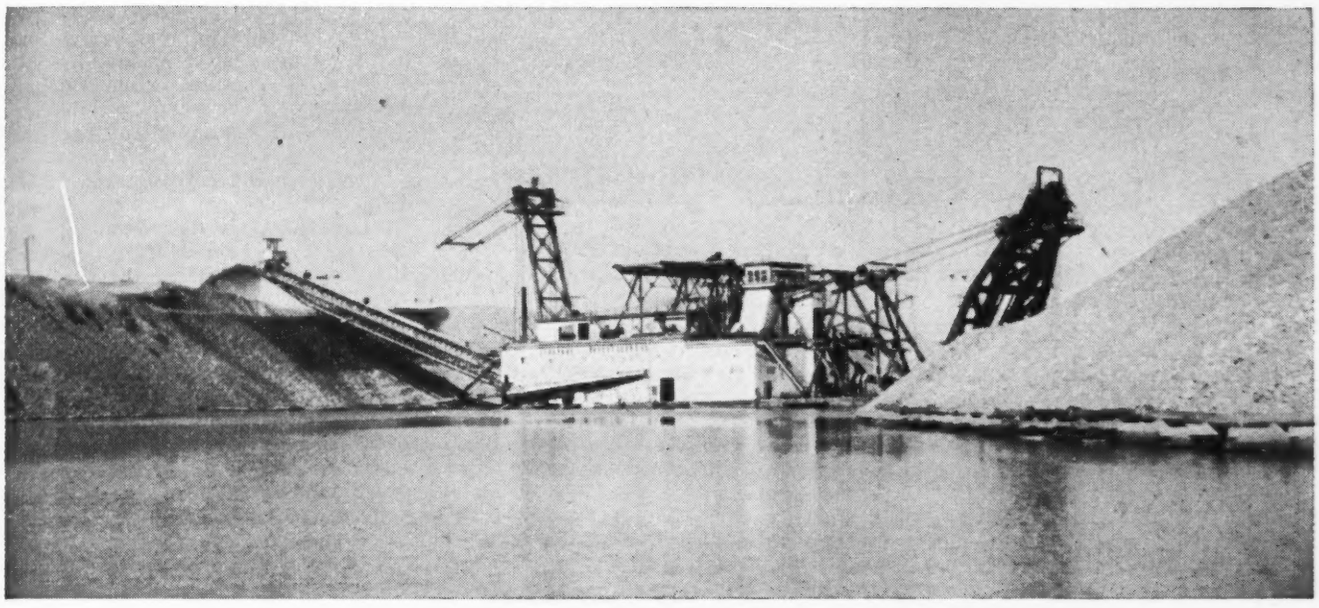
★An unspecified, highly radioactive mineral never before found in Australia is claimed to have been discovered in the Hart's Range district, about 50 miles northeast of Alice Springs. Officials of the Mineral Resources Survey are investigating. Small parcels of pitchblende were discovered previously in the territory.

VICTORIA

★Expectations of a revival in the Bendigo field have not been realized. Six mines suspended operations in the first half of 1947, and only three of the remaining twelve are in regular production.

It is proposed to sink the Central Nell Gwynne shaft, near Bendigo, from its present depth of 1,600 ft. to 2,100 ft. At 820 ft. the main gold-bearing reef of this mine was profitably worked to the boundaries of the lease. Prospecting in existing crosscuts has so far failed to disclose a reef of any importance. It is expected that beds carrying the auriferous quartz so profitably worked on the New Chum line to the east should be contacted on the Nell Gwynne an-

PLACER DREDGE CONSTRUCTION— by YUBA



Yuba Consolidated Gold Fields Dredge No. 20 operating at Hammonton, California, since 1939. It was designed and built by Yuba Manufacturing Company and has 18 cu. ft. buckets to dig 124 feet below water level. This is the *largest and deepest digging* placer dredge built in the United States to date for use anywhere in the world. The picture shows the dredge operating in the midst of old tailings piles from past dredging.

Placer dredging for gold in California was first tried on the Yuba River about 1852. Inefficient equipment lead to early abandonment of the project. The dredging site, however, was near the present field of Yuba Consolidated Gold Fields where Yuba dredges have been used successfully for the past 40 years.

In the Hammonton field, deep digging dredges are now digging old tailings piles for the second, even the third time, reaching pay dirt at depths greater than 150′ below ground level. Two dredges in the Hammonton field displace about 4,000 tons in operating condition and are designed to dig 112′ and 124′ respectively below water level against banks 50′ high if necessary.

Only from experience gained in actual placer dredging can a successful dredge be designed. As dredging ground becomes more difficult to dig because of great depths, boulders, excessive sand or other reasons, it becomes apparent that the design of your dredge cannot be left to chance. Yuba's experience includes the field construction of new and rebuilt dredges and the moving of dredges from one field to another.

Many Yuba dredges still operating today are over twenty-five years old, many have been redesigned and moved and used in two or more dredging areas since first being built. Many dredges built originally in United States have been dismantled and shipped abroad, thereby extending their useful lives by many years. Yuba's experience includes the dismantling and shipping of such dredges, also the redesigning of them to insure successful operation in new placer deposits.

If your plans include placer dredging, you are invited to consult with experts in the Yuba organization without obligation. Some Yuba dredge, no doubt, has successfully handled ground such as you have in mind.

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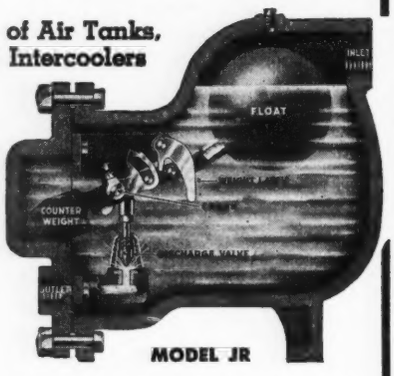

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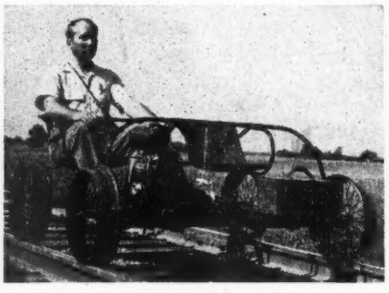

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Australia (*Continued*)

ticline at a depth of about 2,000 ft.

Work on sinking the main shaft of the South Virginia mine in the Bendigo field, from the then existing depth of 720 ft., commenced in 1946. The shaft has been deepened 120 ft. and crosscuts have been driven from Nos. 7, 8, and 9 levels. In view of the importance attaching to synclinal folding in this area and to values disclosed in the synclinal reef above the No. 5 level, the crosscut at the No. 9 level (867 ft.) will be extended to prospect the reef showing in Nos. 6, 7, and 8 levels.

★In the Beechworth district, the rich Red Robin mine at Hotham Heights continues to yield outstanding returns from small-scale operations. Six tons of ore crushed yielded 192 oz.

★Two new companies, the Northern Star, Kevington, and the Tawonga Gold Mine, Tawonga, are preparing to commence operations.

★In the Gippsland district, a new shaft is being sunk at the Black Cameron mine. It is anticipated that the main reef will be cut at 100 ft. Work at the old shaft has ceased. Shaft sinking continues at the Golden King mine, Yarrambat. At the Pride of the Mountain mine, Aberfeldy, crushings yielded up to 15 oz. per ton.

TASMANIA

★In its annual report the Electrolytic Zinc Company of Australia stated that recurring shipping difficulties help up supplies of concentrates and calcines from the mainland and restricted electrolytic operations at Risdon. Zinc output for the year dropped 10,144 tons to 70,314 tons. The position is expected to be relieved by a chartered vessel which will be placed in operation shortly, between Tasmania and the mainland. At the end of the report year, a backlog of 228,000 tons of concentrates and calcines, equivalent to one year's refining capacity, had accumulated at Port Pirie.

The lead concentrate from Electrolytic Zinc's own workings is sold overseas as it is not acceptable for treatment at the Port Pirie smelters. Similarly, copper concentrates with high silver and gold values will be exported for the time being. However, the refinery at Port Kembla may be equipped shortly to deal with this concentrate in Australia.

Because of the continued pegging of the domestic price of zinc at less than one-third of world parity, an inordinately high proportion of the company's output is taken up by domestic consumers.

Duluth Meeting

(*Continued from Page* 122)

A paper on recent developments in "jet-piercing," a term newly adopted for fusion piercing by Linde Air Products Co., was presented by J. H. Zimmerman, manager of the Linde company's development division. This paper will be published in *E. & M. J.* for March. Part of it is devoted to a discussion of present methods of distributing the oxygen used in piercing. (A brief sketch of the highlights of the up-to-date jet piercing procedure is given on page 103 of this issue.) Interestingly, Mr. Zimmerman announced that Bucyrus-Erie Co. will build the rigs for jet-piercing.

Drilling Outpoints Blasting in New Developments

Developments in drilling and blasting were discussed on the second day of the Symposium. M. W. Thomassen and F. D. Vines dealt with the former, L. C. David presiding, and D. E. Albon and E. M. Fowler with the latter, R. W. Whitney being on the program as chairman.

Pointing out the attention being given to drill design for underground work, Mr. Thomassen said that a working combination of drill, drill mounting and drill bit is necessary. The trend is to a lighter, more automatic drill. Respecting tungsten-carbide bits, he referred his audience to the paper presented by R. W. Adamson at the El Paso meeting late in October. Formerly it was asked how many bit usages could be obtained before rod failure; now with carbide bits the question is how many rods will be used before bit failure. Carset bits, he said, now made only in 1⅛ in. size, are being developed in 1⅜ in., 1⅝ in., 1¾ in. and 2-in. sizes. His company, Ingersoll-Rand, was announcing a new drilling jumbo and a new long feed powered by a multivane motor and taking a 6-ft. change. I-R also had a new 14-lb. auto-feed jackhammer, striking 3,000 blows per minute, for the industrial field and for mining maintenance and repair work; also a new 7-lb. air-motor M-G set for maintenance work where electric power is not available. Mr. Thomassen spoke of the need of a self-contained, air-operated drill for putting down 6-in. holes on surface and described the steps, now completed, that had been taken to supply it.

Mr. Vines, representing the Bucyrus-Erie Co., discussed up-to-date churn-drilling practice. He pointed out the trend to 9-in. and larger holes, the advantages being that the ratio of tool weight to inch-diameter could be increased and that fewer holes need be drilled for a given tonnage. His company had built two Carset bits of 6-in. diameter and had drilled 40 ft. with one without resharpening.

At the session of blasting, Mr. Albon presented a paper by D. B. Mathes on the use of liquid-oxygen explosive, "Airmite" in this case. This explosive is much used in coal stripping. Mr. Fowler said that research in explosives during the war had produced "no new development save the atomic bomb."

The smooth center hole in Bethlehem Hollow Drill Steel does not just happen that way. Metallic cores of accurate size are inserted into the drilled billets of carbon tool steel which have passed scrupulous inspection. The billets are then reduced to bars of proper size and shape by precision rolling over the core, which when withdrawn leaves a smooth, uniform hole.

There are many other considerations in producing fine drill steel, but it *is* important that the hole be free from imperfections which lead to fatigue-failure and premature breakage. And any drill runner knows how drilling slows up when the hole is not true.

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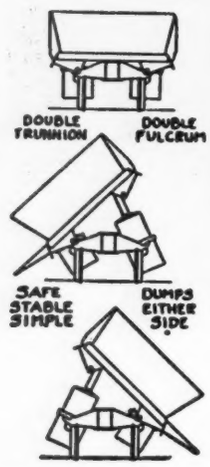


DIFFERENTIAL AIR DUMP CARS • MINE CARS •
LOCOMOTIVES • ROCK LARRIES •
HAULAGE SYSTEMS
DIFFERENTIAL STEEL CAR CO. FINDLAY, OHIO

Washington Meeting

(Continued from page 124)

processes to which fluidization will probably bring improvements, including calcination, roasting, ore reduction, regeneration, heat transfer and coal gasification, he stressed the vast surface of contact between small solid particles and a supporting gaseous medium. This amount of surface permits laboratory-sized models to do the work of commerical-size rotary kilns or rabbled hearths. He demonstrated a multiple stage model with stage control exercised by varying the amount of gas passing through individual compartments.

Dr. H. F. Yancey, of the U. S. Bureau of Mines, discussed and demonstrated the Dutch State cyclone. He described the device as a better separator than the accepted standard, wet tables, and as offering great capacity in very small space. Used as a thickener, the cyclone makes a complete recovery of plus-200-mesh material. Thus, when finer material is present, it can greatly reduce the loads on thickeners. In answer to questioning he described the device as multiplying gravity 2000 times.

Dean Emeritus Milnor Roberts showed a number of colored slides of Western mining views.

In the afternoon session, W. A. Richelsen, consulting mining engineer, discussed "The Mining Outlook and Recent Developments in British Columbia, Yukon Territory and Alaska." Prospecting in these areas has been active in the past two years but has turned up nothing of great importance. High wage levels and increased costs have made development of remote areas, heavily dependent on gold, difficult. He offered the opinion that British Columbia is the most promising of these areas.

F. W. Libbey, director of the Oregon State Department of Geology and Mineral Industries, described "Bauxite Developments in Oregon." He stated that there are extensive deposits, generally high in iron but low in silica, along the Columbia River and extending into Washington, also some smaller deposits in the vicinity of Salem. He did not view the iron content as a serious handicap, pointing out that the iron residues from the Bayer process would probably have commercial value.

Dr. V. D. R. Kirkham, consulting geologist, discussed "Magmatic Segregations in Canada, Idaho and Montana," referring to copper-nickel segregations in Pre-Cambrian basic sills which he considered of commercial interest.

Prof. W. S. Hopkins, discussing "Labor Relationships," offered the opinion that, despite the Taft-Hartley Act, the power and momentum of the labor movement would bring about further encroachment by labor into what are regarded as management's rights.

Addressing a joint evening session of the Institute and the North Pacific section, AIME, Evan Just, editor of *Eng. & Min. Journal*, spoke on "Gold Problems and the Outlook for the Mineral Industry." He stated that metal prices seem likely to stay relatively high in 1948, that excessive inflation foreshadows a recession, and that mining has a task of making working places and communities more attractive and work less arduous in order to meet new attitudes and competition. In regard to gold he viewed a higher price as inevitable but not in the near future. Referring to the Treasury attitude, more or less unfriendly to the current interest of gold producers, he pointed out that the principal Treasury motive is to protect the integrity of Government borrowings, an objective to which right-minded citizens must subscribe, considering the widespread losses to creditors which result from devaluation and the discouragement of effort and saving which result. Nevertheless once inflation is an accomplished and irrevocable fact, devaluation may prove to be an energizer by restoring confidence in government credit under new conditions.

He recommended curbing of Government extravagance, devaluation if necessary, based on an objective study of actual capacity to retire Government debt, and free circulation of gold.

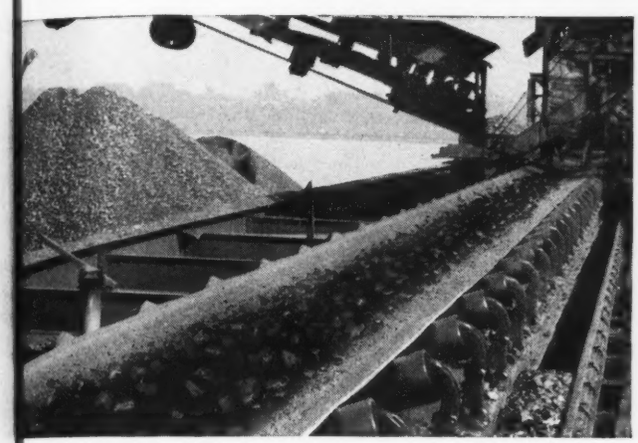
Russians Push Mining Of Uranium in Saxony

Official German newspapers of the British and American military governments have reported recently that the Russians are employing 100,000 German men and women in uranium mining operations in southern Saxony. Working conditions are reported to be dangerous, but wages are comparatively good because of special bonuses in foods, fats, and tobacco. These bonuses stop, however, if workers become ill. Most of the information was revealed by workers who fled to western areas. One German newspaper reported that 96 German workers were killed in a recent shaft disaster in a uranium mine.

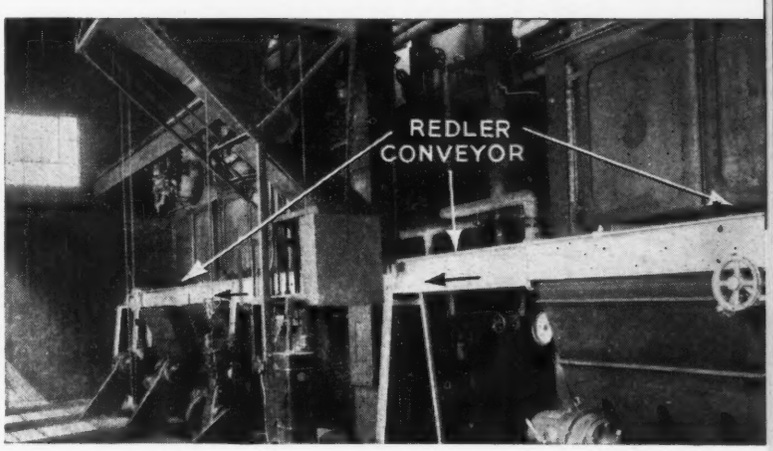
Treasury Tightens Gold Export Regulations

The Treasury ruled on Jan. 2 that gold-bearing material imported for processing may not be re-exported if any United States national or United States firm participates in the sale of the gold. A refiner may treat foreign gold-bearing material on a strictly service-charge basis and re-export the gold to its foreign owner, but if any United States national or firm participates in the re-sale of the metal the gold cannot be legally exported.

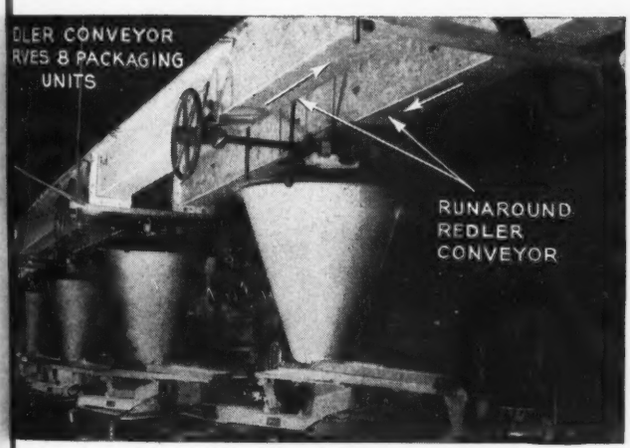
Do you see the answer to your bulk material handling problem here?



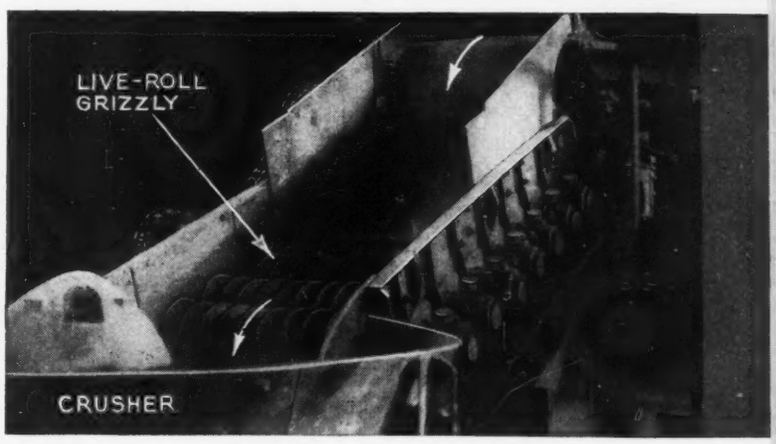
One of hundreds of Stephens-Adamson engineered coal conveyor systems. This one has unloaded, stored, screened and delivered 300,000 tons of coal a year since 1926 with practically no repairs. Similar systems are cutting costs of handling aggregate, ore and other bulk materials. Each system is specially engineered for the job—easy for S-A because S-A makes all types of conveying equipment and accessories—S-A can use the exact type of equipment the job requires.



Feeding coal to boiler hoppers is a job made-to-order for an S-A engineered REDLER Conveyor System. Sealed casings eliminate coal dust. Inherently compact, REDLER systems save space, reduce need for bulky equipment. They move bulk materials fast in a solid mass horizontally, up, down, around corners, anywhere. A perfect example of low-cost handling with the right equipment engineered into the right system.



When absolute cleanliness without disturbance of balance of mixed ingredients is needed, S-A REDLER Conveyor-elevator Systems get the call. The system shown here conveys food ingredients, distributes the mixture to battery of packaging machines. Sealed casings prevent contamination, eliminate waste from spillage. S-A engineered REDLER Systems are in wide use in the food processing and chemical fields . . . can be engineered to meet virtually any bulk material handling problem.



Special handling problems are readily solved by S-A engineers with their unlimited access to the right equipment, all built by S-A. Here you see an S-A Live Roll Grizzly used to feed large lumps of ore to crusher, while passing fines through to belt conveyor below. What's your handling problem? Difficult? Involved? Talk it over with S-A engineers. Let them show you how the right equipment, engineered into the right system can provide the efficient, economical answer.

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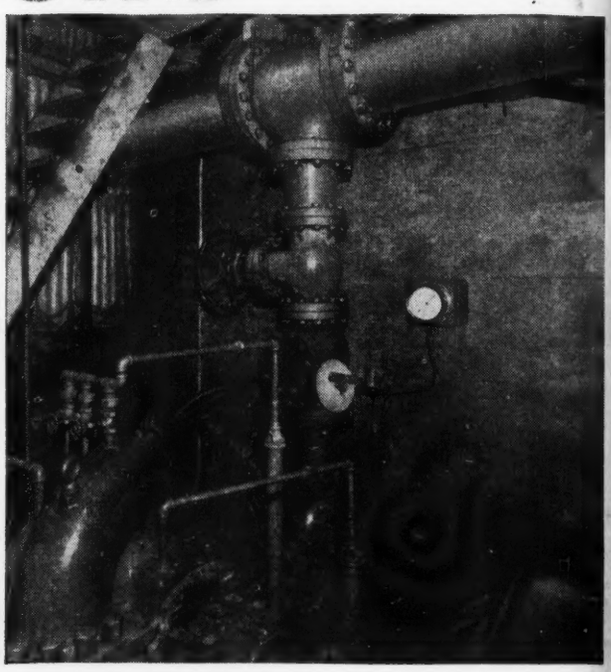
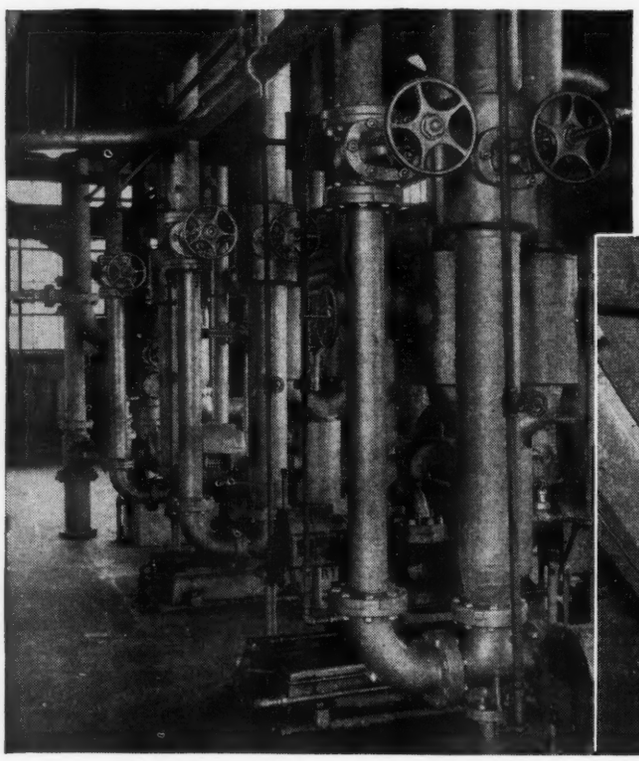
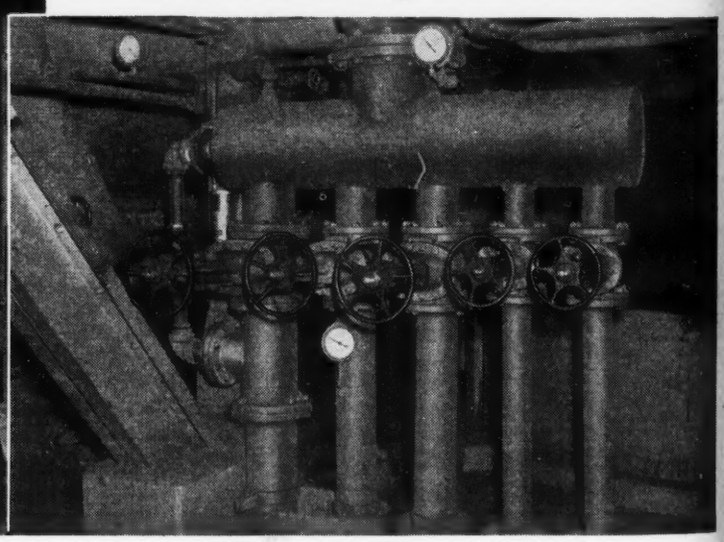


LIFTING WATER 1960 FEET *through a Crane-equipped piping system featuring 250-pound iron valves and fittings.*



A LARGE BREAKER PLANT'S *power house showing boiler feed piping, equipped from the complete Crane line.*



MANIFOLD TO PEA AND BUCK CONE *in breaker plant; also to agitator rings and classifier. One order to Crane gets all the piping materials.*

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FITTINGS
PIPE

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PLUMBING
AND
HEATING

FOR EVERY PIPING SYSTEM